



**ADVANCES IN THE ECONOMIC ANALYSIS OF  
PARTICIPATORY AND LABOR-MANAGED FIRMS  
VOLUME 10**

**COOPERATIVE FIRMS IN GLOBAL  
MARKETS: INCIDENCE, VIABILITY AND  
ECONOMIC PERFORMANCE**

**SONJA NOVKOVIC  
VANIA SENA  
Editors**

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AND ECONOMIC PERFORMANCE**

# ADVANCES IN THE ECONOMIC ANALYSIS OF PARTICIPATORY & LABOR-MANAGED FIRMS

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# CONTENTS

LIST OF CONTRIBUTORS	<i>vii</i>
FOREWORD	<i>ix</i>
INTRODUCTION	<i>xi</i>
<b>PART I: EMPIRICAL STUDIES</b>	
THE PRODUCTIVE EFFICIENCY OF ITALIAN PRODUCER COOPERATIVES: EVIDENCE FROM CONVENTIONAL AND COOPERATIVE FIRMS <i>Derek C. Jones</i>	<i>3</i>
ORGANIZATIONAL CAPITAL, PRODUCT MARKET COMPETITION AND TECHNICAL EFFICIENCY IN ITALIAN COOPERATIVES <i>Ornella Wanda Maietta and Vania Sena</i>	<i>29</i>
EFFICIENCY, ECONOMIC PERFORMANCE AND FINANCIAL LEVERAGE OF AGRIBUSINESS MARKETING CO-OPERATIVES IN CANADA <i>Getu Hailu, Scott R. Jeffrey and Ellen W. Goddard</i>	<i>47</i>
INTRODUCING DIFFERENTIAL WAGE RATES IN THE KIBBUTZ ECONOMY: IS IT THE END OF THE KIBBUTZ? THEORY AND NEW DATA <i>Ehud Satt</i>	<i>79</i>
THE QUALITY OF MANAGEMENT IN BASQUE COMPANIES: DIFFERENCES EXISTING BETWEEN COOPERATIVE AND NON-COOPERATIVE COMPANIES <i>Jon Charterina Abando, Eneka Albizu Gallastegi and Jon Landeta Rodriguez</i>	<i>109</i>

ESTIMATING PRICING GAMES IN THE WHEAT-HANDLING MARKET IN SASKATCHEWAN: THE ROLE OF A MAJOR COOPERATIVE <i>Jing Zhang, Ellen Goddard and Mel Lerohl</i>	151
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## PART II: THEORETICAL STUDIES

COOPERATION AND EFFORT, RECIPROCITY AND MUTUAL SUPERVISION IN WORKER COOPERATIVES <i>Roger A. McCain</i>	185
---	-----

R&D, INNOVATION AND NETWORKING: STRATEGIES FOR COOPERATIVE SURVIVAL <i>Sonja Novkovic</i>	205
---	-----

SELF-FINANCING IN LABOR-MANAGED FIRMS (LMFS): INDIVIDUAL CAPITAL ACCOUNTS AND BONDS <i>Ermanno C. Tortia</i>	233
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## PART III: GLOBAL PERSPECTIVE

THE IMPACT OF GLOBALISATION AND RELOCATION STRATEGIES IN LARGE COOPERATIVES: THE CASE OF THE MONDRAGÓN COOPERATIVE FAGOR ELECTRODOMÉSTICOS S. COOP <i>Anjel Errasti and Antton Mendizabal</i>	265
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A NOTE ON THE FUTURE AND DYNAMICS OF ECONOMIC DEMOCRACY <i>Jaroslav Vanek</i>	297
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# FOREWORD

This volume of *Advances in the Economic Analysis of Participatory and Labor Managed Firms* is the tenth in the series. The series began in 1985 and until 1998 six volumes appeared. Then the series was published by JAI and Jan Svejnar and I were co-editors. The series was re-launched in 2003 when volume 7 (edited by Takao Kato and Jeffrey Pliskin) appeared as the first volume to be published by Elsevier. Subsequent volumes, both published by Elsevier, were edited by Virginie Perotin and Andrew Robinson (Volume 8, 2004) and by Panu Kalmi and Mark Klinedinst (Volume 9, 2006.)

A key aim of the re-launched series is to publish *Advances* on a regular and, preferably, on an annual basis. Reflecting a deepening pool of talent as the field of participation has grown during the last twenty years or so, another change has been to make frequent use of guest editors for issues of *Advances*. As series editor, I welcome suggestions and proposals from readers for particular issues. Other changes concerning *Advances* have been more modest.

*Advances* will continue to act as a forum for high-quality original theoretical and empirical research in the broad area of participatory and labor managed organizations. The original rationale for the series was the observation that while general and specialized journals publish work in this field, many do so only occasionally. There continues to be a need for an annual periodical that presents some of the best papers in a single volume.

While the focus will continue to be on economic issues, analytical studies on closely related areas are also welcome. *Advances* will also continue to serve as an outlet for high-quality pieces that regular journals often consider to be too long.

The broad area of participation and labor management has changed much since the inception of the series in 1985. The tragic disintegration of the Former Republic of Yugoslavia also meant the disappearance of the principal systemic example of self-management. But the collapse of the former USSR has also triggered widespread experimentation with diverse forms of participation in many transition economies, notably many firms with large degrees of employee ownership. Amongst firms in western economies we also witness the continued growth of diverse institutional

arrangements that provide for participation by employees in decision-making as well as in enterprise results. Also several important examples of worker cooperatives continue to thrive, with the Mondragon Cooperative Corporation now representing the seventh largest consortium in Spain.

Against this institutional backdrop much new and innovative theoretical and empirical work in the broad field has appeared. The key aim of the *Advances* series continues to be to make it a broad-based periodical within which is presented both new theoretical results and fresh evidence on the performance of participatory firms and sectors. The intent is to maintain high quality and to place this periodical among other successful Elsevier series. I hope you will be informed and stimulated by this volume and that you will consider contributing to it and conveying information about *Advances* to other interested colleagues.

Derek C. Jones  
*Series Editor*

# INTRODUCTION

A number of competing views are swirling around the literature concerning the impact of globalization on the ability of cooperatives to survive. Some argue that globalization provides co-ops with the incentives to improve their own performance and to better compete with conventional firms, while others maintain that globalization pushes co-ops out of the market. Others contend that the most efficient co-ops are those that gain a larger market share and thus are able to affect the state of competition in the product market.

Providing more solid empirical information on these and related questions is of more than theoretical and empirical interest since these matters have immediate relevance for policy purposes: the increasing integration of what were once national product markets implies that even co-ops (traditionally operating in niche segments of national markets) have to face increasing competitive pressure from foreign firms, in ways comparable to what is happening with conventional firms. It is commonly believed that structural reasons (such as under-capitalization, short-sightedness due to the need of serving the membership's interests and so on) prevent co-ops from coping successfully with intense competition and that this will eventually lead to their dissolution. In some regions and sectors, such as agriculture in North America, for example, cooperatives have faced increasing demutualization under competitive pressures. However, this is not necessarily the case. Indeed cooperatives have proven to be an organizational form that is robust to increasing market pressure while at the same time trying to be faithful to their values, helping support regional development and allowing equal income distribution. In some regions, such as Northern Italy and Basque region in Spain, they have been agents of regional wealth accumulation and significant players in global markets. Then, the question becomes: why do we observe these different evolution paths among co-ops; what are the conditions under which a co-op can successfully compete in global markets and what are the best strategies it can follow?

This 10th issue of *Advances* aims to understand some of these elements in the evolution of cooperatives in a world where globalization seems to be the driving force of innovative forms of organization. In keeping with the main

focus of the economics literature, the volume is focused on worker and producer cooperatives. This issue contains 11 papers and is organized into three parts: the first part collects empirical studies on producers' cooperatives in Israel, Italy, Spain and Canada. The second part focuses on theoretical advances in the literature on cooperatives with the declared objective of understanding the conditions that explain the co-ops' longevity. Finally, the third part documents the expansion into the global markets of the Mondragón Cooperative Corporation.

From a theoretical point of view, it is possible to argue that one source of longevity of co-ops is the large productivity gains co-ops experience compared to conventional firms. While many theoretical arguments have been put forward to support this hypothesis, the existing empirical evidence is inconclusive concerning the comparative performance of LMFs and conventional firms. By assembling and analyzing new data for a sample of 51 conventional firms and 26 producer cooperatives in the Italian construction industry during the period 1981–1989, the first paper in the *Empirical studies* by D.C. Jones provides additional evidence on this issue. Based on translog production function estimates, and unlike some previous econometric studies, the paper finds no consistent evidence of significant productivity differences between cooperatives and conventional firms. However, as co-ops and conventional firms in the construction sector appear to be operating in different segments of the market, it is possible that the estimated productivity effects capture differences in the firms' economic environment rather than actual differences in productivity and in this respect the paper invites to identifying the institutional settings that are favorable to cooperatives.

The second paper in this section, by O.W. Maietta and V. Sena, analyses the mechanisms through which increasing market competition may help producers' cooperatives to improve technical efficiency to guarantee positive profits. This hypothesis is first formalised in a partial equilibrium framework where the authors show that as competitive pressure erodes the co-ops' profit margins, workers and members will be keener to increase their effort and this in turn will have a positive impact on the co-ops' technical efficiency. This prediction is tested on a sample of 413 conventional and cooperative firms drawn from the Italian wine sector. Technical efficiency indexes are computed by using the one-stage approach as suggested by Battese and Coelli (1995), where proxies for competition are introduced as determinants of efficiency, along with other exogenous factors accounting for the firms' heterogeneity. The results support the hypothesis that increasing market competition can affect positively the cooperatives' efficiency.

It is well documented that the agricultural cooperative sector in Canada is subject to substantial competitive pressure from both local and multinational firms; one consequence of this increasing competition has been an increase of debt leverage (together with a decrease in their profit margins) for the co-ops. This has cast some doubts on the long-run financial viability of agricultural co-ops in Canada with a general expectation that they will dissolve. However, the impact that debt leverage has on co-ops' performance is ambiguous: indeed, from a theoretical standpoint, it is possible to argue that increasing financial pressure may induce the co-ops to cut the slack in its productive process and so to improve its cost-efficiency. At the same time, the higher agency costs created by the conflicting interests between shareholders and debt holders may have a negative impact on the co-ops' efficiency. This ambiguity makes it therefore interesting to ascertain empirically the nature of the relationship between financial leverage and co-op performance. This is indeed the main objective of the third paper by G. Hailu, S.R. Jeffery and E.W. Goddard. Using the stochastic frontier models pioneered by Lovell et al. (1977), the authors measure the cost efficiency of 96 agricultural co-ops in Canada over the period 1984–2001 and they measure the impact of financial leverage and firm size on their cost efficiency. The results show that an increase in the degree of financial risk has a negative impact on the co-ops' cost efficiency; this may be due to the fact that an increase in the level of debt increases the agency costs between members and debt holders. However, the impact on cost efficiency of changes in the capital structure induced by the increase in debt leverage is more uncertain. Interestingly, it appears that co-ops in the dairy and grain sectors are capable of internalizing the impact of changes of the capital structure by improving their cost efficiency.

The fourth paper, by E. Satt, examines the effect of the introduction of differential wages on the Kibbutz economy. The differential wage model plays a central role in the process of change the Kibbutzim economy has gone through. The main objective of this process is to increase the Kibbutzim economic efficiency. Indeed the argument is that differential wages can motivate individual members to put more effort into the kibbutz and so will increase the profit margin for the Kibbutz. The paper tries to predict the evolution of the Kibbutzim system by showing that this may ultimately create the conditions for the collapse of the system.

The paper by J. Charterina Abando, E.A. Gallastegi and J.L. Rodriguez analyses the differences in management practices between co-ops and conventional firms by using data of 503 companies located in the Basque Autonomous Community in Northeast Spain. The results show the

management practices of co-ops and conventional firms differ significantly; in particular co-ops score better in keeping workers' needs and expectations satisfied.

The sixth paper in this section is by J. Zhang, E. Goddard and M. Lerohl and again looks at Canadian co-ops, but this time in Grain-Handling sector. The proportion of co-ops in the Grain-Handling sector in Canada has always been relatively high. However, the structure of the industry has dramatically changed in the past 20 years as the co-ops' market share has decreased from 70% in 1986 to 47% in 2000, and as of today (2006) no co-op is present in this industry. What is the impact on social welfare of the disappearance of co-ops in this sector? If we accept the hypothesis that co-ops may induce investor-owned firms to behave more competitively, then social welfare is bound to be harmed by the disappearance of co-ops. This paper examines these issues. More specifically it tests empirically the potential yardstick effect of co-operatives in an industry where both co-ops and investor-owned firms behave in a non-cooperative manner. The authors use comparative data of the Pioneer Grain (investor-owned firm) and the Saskatchewan Wheat Pool (the co-op) over the period 1980–2004. Interestingly, the results find evidence of the yardstick effect of the co-op in this industry as the Saskatchewan Wheat Pool and the Pioneer Grain appear to have played a Bertrand game.

The second part of the volume, *Theoretical studies*, consists of three theoretical papers. As mentioned above, several theoretical explanations have been given to justify the perceived superior performance of co-ops. The paper by R. McCain contributes to this literature in several respects. The author reconsiders the theory of effort provision in cooperatives, where he incorporates the notion of reciprocity and non-self interested motives in individuals into the model. Effort supply problem is treated as a social dilemma, where a cooperative game theoretic solution is labeled the social norm. In this framework, McCain shows that the addition of reciprocity in a team-monitoring context may explain the higher productivity observed in cooperatives.

The persistence of cooperatives in competitive markets has rarely been linked to innovation and networking capabilities of cooperatives in the literature. The paper by S. Novkovic applies evolutionary modeling techniques and computer simulations to model research and development strategies of co-operative firms in a mixed economy of the Nelson and Winter type. The paper explores possible differences in innovation and imitation strategies of co-operatives that may provide some insights into relative scarcity of co-operative forms of organization in market economies.

Different probabilities of innovation and networking are explored in the context of the two types of firms competing in the same industry. The model captures some observed features of co-operatives, such as their increased presence in labour-intensive industries, and explores the creation of co-operative networks as a strategy for the survival of co-operative form of organizations in mixed industries.

Finally, one argument that is usually put forth to explain why co-ops dissolve in market economies, is the relative under-capitalization of co-ops that does not allow them to compete successfully in a global market place. E. Tortia revisits the Furubotn and Pejovich horizon problem of cooperative members that results in the under-capitalization of cooperatives due to the lack of incentives to invest out of the net income. The author proposes an institutional solution to this problem, in the form of internal bonds of the cooperative used to cash out individual capital accounts of departing members. Forming a market for cooperative bonds, risks are shared between the cooperative members and outsiders, with internal control remaining in the hands of the members.

The third part of the volume, *Global Perspective*, consists of two papers. The A.M. Errasti and A. Mendizabal paper is a case study of Fagor Electrodomesticós, a member co-operative of the Mondragón Cooperative Corporation (MCC), who opened subsidiary companies across the world under competitive pressures, and transformed into a multinational company. The paper gives insights into the dilemma of co-operative firms in dealing with demands of cost and price competition, while maintaining their co-operative identity. The authors detail current global trends of relocation, the place of Fagor relative to its competition in the European market, and strategies of acquisitions and capital-based expansion this MCC member is currently pursuing. The study ends with recommendations for increased participation by foreign labour force in Fagor's subsidiaries. J. Vanek's commentary on MCC's path to global markets follows the Errasti and Mendizabal's paper, where author expresses some optimism for the enlargement of co-operative structures, in light of participatory management approaches in a co-operative multinational firm.

As with previous volumes of the *Advances* series the papers in this volume of *Advances* draw on the expertise of a number of prominent authors in the broad field of participation and labour management. We hope that the insights contained in these essays, and especially the focus of many on issues surrounding cooperatives in a globalized world, will help to enhance knowledge about cooperative forms of organization, and to produce policy advances too.



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**PART I:**  
**EMPIRICAL STUDIES**

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# THE PRODUCTIVE EFFICIENCY OF ITALIAN PRODUCER COOPERATIVES: EVIDENCE FROM CONVENTIONAL AND COOPERATIVE FIRMS

Derek C. Jones

## ABSTRACT

*Existing theoretical and empirical evidence is inconclusive concerning the comparative performance of labor-managed firms (LMFs) and conventional firms. By assembling and analyzing new data for a sample of 51 conventional firms and 26 producer cooperatives in the Italian construction industry during the period 1981–1989 we provide additional evidence. Except for organizational form, the cooperatives in our sample are fairly comparable to our conventional firms. Based on our production function estimates, and unlike some previous econometric studies, we find no significant productivity advantage of cooperatives over conventional firms. Our ordinary least squares (OLS) point estimates generally indicated that output would be lower in a cooperative than in an otherwise identical conventional firm. The only statistically significant measure of financial and decision-making participation is collective reserves. We conclude by offering some possible explanations for why our results may*

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*differ from some previous findings, especially those for Italian producer cooperatives. In particular we suggest that research methods that are new to the study of cooperatives are needed to help to resolve these questions.*

## 1. INTRODUCTION

One of the central and enduring issues concerning labor-managed firms (LMFs), considered hereafter as producer cooperatives (PCs) in western market economies, is their economic performance. While the first econometric studies of the performance of LMFs appeared almost 30 years ago, the issues that are examined in that literature are still not definitively settled. Thus while the metaanalysis by Doucouliagos (1995) concludes that the balance of evidence demonstrates better performance by PCs compared to participatory capitalist firms, other assessments, including Bonin, Jones, and Putterman (1993, 1305) and Dow (2003, 184), are not so sanguine. This is particularly the case when evaluation is restricted to studies that endeavor to make comparisons between PCs and conventional firms within the same industry (for a review, see, e.g., Dow, 2003, 184). In this paper, we contribute to this relatively limited set of literature by using a panel data set for Italian producer cooperatives and conventional firms in the construction sector to investigate technical efficiency. These data enable us to address what are believed to be many of the quite demanding data requirements for the design of such studies and also to do so for firms that are part of the largest worker cooperative sector in an industrialized country.

Several developments have fostered a renewed interest in the performance of firms that are substantially controlled by workers. On the intellectual front, a key factor is the recent appearance of substantial new assessments of LMFs, most notably Dow (2003), but also Pencavel (2001). A related development is the explosion of a growing body of literature that examines diverse issues relating to economic viability concerning many forms of participatory firms, including co-determination, forms of shared capitalism including employee ownership, and teams.<sup>1</sup> Accompanying these changes we witness the emergence of diverse forms of organization in the former communist countries including firms that formally provide for substantial degree of ownership by nonmanagerial employees (e.g., for Estonia, Jones, & Mygind, 2002). Also substantial and significant sectors of worker-managed firms persist, notably the Mondragon cooperatives, the seventh largest consortium in Spain. And on the policy front the western world has been

shaken by several recent corporate scandals, such as at Enron, which call attention to issues of corporate governance. The upshot of all of this is that the issues of the comparative performance of different organizational forms, including labor-managed firms and traditional capitalist firms, is again a timely one.

We believe that the method we use in this paper and the data we use have useful properties when compared with many earlier comparative studies. The construction industry is interesting because construction cooperatives are mostly long-established firms, are comparable in size to conventional firms (at least in terms of average employment), and were typically formed as new firms rather than transformed private firms that failed (Zevi, 1982; Pittatatore & Turati, 2000). Thus, it appears reasonable to assume that estimated productivity differences reflect organizational features of the firms rather than size, formation, or life-cycle effects. However, as we will discuss below, some cooperatives might differ from conventional firms because they merged with other cooperatives to save jobs rather than to improve efficiency. Also compared to many influential studies our data set is reasonably large – we use a sample of 51 conventional firms and 26 producer cooperatives in the Italian construction industry. In addition we are able to estimate different forms of the production function and choose the appropriate form of technology.

The plan of this paper is as follows. The next section briefly reviews key themes in the theoretical literature and also contains a review of previous empirical work. This is followed in Section 3 by a description of our data. In Section 4, we describe the production function approach that is the basis of our estimating framework. Our empirical results are presented and discussed in Section 5. We offer concluding remarks in Section 6.

## **2. THEORY AND PREVIOUS EMPIRICAL WORK**

Since ours is not a theoretical contribution, we merely review some of the central themes in the literature. The key point is that economic theory yields conflicting predictions about the productivity effects of worker participation in profits, ownership, and decision-making and is thus inconclusive concerning the expected comparative performance of PCs and conventional firms.<sup>2</sup>

Early theoretical work was often pessimistic concerning the expected performance of PCs. Alchian and Demsetz (1972) and Jensen and Meckling (1979) argue that productivity will be lower in a cooperative because efficient

monitoring of workers requires the monitor to be the claimant on the firm's profits and that the cost of monitoring increases with the number of monitors. Another influential paper is [Holmstrom \(1982\)](#) who argues that effort level is expected to be beset with free-rider problems and thus suboptimal when work takes place in teams (as is expected to be the case in PCs).

These pioneering theoretical papers have elicited a voluminous amount of responses and theoretical objections. Thus many authors including [Macleod \(1984\)](#) and [Weitzman and Kruse \(1990\)](#) show how in a repeated game framework effort supply in LMFs need not be below that in conventional firm. Others point to other benefits of PCs. Thus cooperatives are expected to be more productive than conventional firms because incentives (financial participation), peer-group pressure (horizontal monitoring) and the close identification of cooperative members with the firm will elicit greater effort from workers ([Jones & Svejnar, 1985](#); [Fitzroy & Kraft, 1987](#)).

In light of the ambiguity of economic theory, there is a need for empirical evidence. While the relative performance of conventional firms and producer cooperatives has been estimated by comparing subsample means of measures such as value added per worker using data on both conventional firms and cooperatives,<sup>3</sup> most econometric evidence has been obtained from samples exclusively of producer cooperatives that estimate how the productive efficiency of firms varied with respect to measures of financial and decision-making participation.<sup>4</sup>

The authors of these studies estimated the efficiency of a typical cooperative relative to a firm with no worker participation. Since the samples of cooperatives often exhibited considerable variation over both firms and time in the degree of worker participation, the estimated productivity effects might be reliable. However, other things remaining the same, one would prefer a sample of both conventional firms and cooperatives since the variance of the prediction errors is lower for observations that are similar to those in the sample than for atypical ones.

A few studies have estimated production functions using data on both conventional firms and cooperatives: [George \(1982\)](#); [Jones \(1987\)](#); [Conte and Svejnar \(1988\)](#); [Lee \(1988\)](#); [Berman and Berman \(1989\)](#); [Estrin \(1991\)](#); and [Craig and Pencavel \(1995\)](#). Only the papers by Jones, Lee, and Estrin and [Craig and Pencavel \(1995\)](#) focussed on the relative technical efficiency of cooperatives. In addition, there appears to have been limited decision-making participation by workers in the cooperatives in the George, Jones, and Lee studies. Jones examined the effects of board representation and financial participation in a sample of retail (i.e., consumer) cooperatives. In some cooperatives workers were allowed to become members; in others

workers were excluded from membership. While from the perspective of employees these latter consumer cooperatives were private firms, the cooperatives with worker members are not legally incorporated as worker cooperatives. Lee studied worker-owned firms and conventional firms in Sweden over the 1983–1985 period. However, it is not clear to what degree employees participated in decision making in the worker-owned firms. Estrin used panel data on 49 producer cooperatives and 35 conventional firms in a variety of light manufacturing industries in Italy to estimate Cobb Douglas production functions. While the sample was constructed to include cooperatives and private firms that were fairly comparable in size and in their distribution across industries, Estrin describes his results as a “first cut.” The last three papers did not provide sufficient information to determine the relative technical efficiency of cooperatives. Using data on U.S. plywood firms, Berman and Berman estimated a Cobb Douglas production function for the pooled sample and separate ones for cooperatives and conventional firms.<sup>5</sup> Conte and Svejnar (1988) estimated translog production functions using data on 40 U.S. firms including producing cooperatives in the plywood industry.<sup>6</sup> George estimated separate Cobb Douglas production functions for Danish cooperatives and conventional firms in the construction and bakery industries.<sup>7</sup> However, the degree of worker participation in decision making may be limited by the influence of nonworker shareholders such as trade unions and other organizations.

Finally, and most recently, the study by Craig and Pencavel (1995) is deserving of close examination, in part because of the careful way in which data were gathered and analyzed by the authors for plywood Coops and conventional firms in the Pacific Northwest in that industry. The authors estimate separate Cobb Douglas and production functions for several types of firms including Coops and conventional firms. They find that Coops are between 6 and 14% more efficient than the principal conventional firms though there is little difference between the efficiency of the unionized and classical mills.

In sum, it would seem that a reasonable conclusion based on the research to date is that there is no strong evidence that either cooperatives or conventional firms have a sizeable and persistent significant edge in performance over the other organizational form. Equally it is apparent that there is a need for more targeted research. For example, the most frequently comparative cited study nowadays is probably that of Craig and Pencavel (1995). However, while the quality of the data the authors use is most impressive arguably the robustness of the findings are diminished by the relatively small size of the data set (170 observations for 34 mills), the



use of a problematic measure of capital in the production function estimates and the ability to estimate production functions with only Cobb–Douglas technology.

### 3. ITALIAN PRODUCER COOPERATIVES: INSTITUTIONS

Since informative accounts of Italian Coops exist elsewhere, here we will merely summarize key features, especially those details that are pertinent to subsequent empirical work.<sup>8</sup>

The Italian PC movement is comparatively large and it has been reported that there are 38,000 PCs in Italy (Ammirato, 1996). As a proportion of the overall labor force, they may represent the largest share of the labor force in any country. Italian producer cooperatives have existed for a long time, at least since the late 1800s, and as part of a wider cooperative movement.

The PC sector is strongly affected by the legal framework within which it operates. So far as employee participation is concerned, the law does not provide that all workers must become members of the PC, even after a probationary period. Nonetheless, in Italy, and unlike the experience elsewhere, most workers in PCs are members.

In terms of financial participation, there are numerous institutional provisions that are pertinent. For one thing, the law requires that new members pay an admission fee which is not returned when the member exits the firm. Members are also required to make a capital contribution with the law specifying both the minimum and the maximum amounts that PCs can ask of their members. When members leave the PC, this capital contribution is returned to them, but the individual does not share in any additional capital accumulation that the firm might have enjoyed during the member's tenure at the firm.<sup>9</sup>

A key feature of the law is the stipulation that at least 20% of net revenue must go to reserves (Zevi, 1982). Importantly, these surpluses that do to reserves are not taxed. These provisions tend to lead to firms having capital structures that have a large fraction of assets that are collectively owned. Those net revenues that are not paid into reserves may be distributed to working members as a bonus that is allocated to members in proportion to their earnings. In addition, the net revenues may be used to declare a dividend on individual capital contributions, though this dividend rate is regulated and tends to be capped at the rate paid on government bonds.

Finally, members may make loans to their cooperative. Moreover, the law provides that such loans pay a higher, tax-free interest rate than do comparable bank loans.

#### 4. DATA

The data used in this study were obtained from two sources. The data on producer cooperatives were supplied by a regional umbrella organization for cooperatives in Emilia Romagna, that was part of the Lega federation of Coops. Data on conventional firms were obtained from various annual editions of *Le Principali Società Italiane*, a publication prepared by Mediobanca that reports economic data on large Italian enterprises.<sup>10</sup>

Since the Mediobanca publications also include data on seven producer cooperatives that are represented in the cooperative data set, we were able to examine how closely data from the two sources match. We examined five variables that were used in the econometric analysis: real value added, real fixed assets, labor, real profits, and real labor costs (The last two variables are used to construct instruments). For each variable except real profits, we regressed the natural logarithm of the variable from the Mediobanca data set on the natural logarithm of the corresponding variable from the cooperative data set, a constant term, and six firm dummy variables to capture scale differences among the firms.<sup>11</sup> For real profits, which are negative for some observations, we used the level of real profits instead of its natural logarithm. In all regressions, we obtained an  $R^2$  that exceeded 0.99, and except for labor and real fixed assets, the slope coefficients (i.e., the coefficients on the variables from the cooperative firm data set) were between 0.97 and 1.01. The slope coefficient on the labor variable was 0.62, which partly reflected the influence of one observation in which the data sources reported very different figures for labor. (When we excluded this observation, the slope coefficient rose to 0.81.) The slope coefficient on real fixed assets was 0.89, and it rose to 1.01 when we excluded the observation for which there was a relatively large discrepancy between the two data sources. If the six firm dummy variables are omitted, all  $R^2$ s continue to exceed 0.99 and the regressions coefficients are all between 0.99 and 1.03. In the case of labor and real fixed assets, the coefficients are influenced strongly by scale effects.<sup>12</sup>

The reasonably close correspondence between the two output series<sup>13</sup> is reassuring since we were not able to construct value added in the same manner that it was computed by Mediobanca. Value added was computed by Mediobanca as sales + final inventories – initial inventories – purchased

inputs + any capitalization of fixed assets and cost adjustments (such as expenses recovered from customers or third parties) + income earned from activities other than normal business activities business. We lacked the appropriate data to account for capitalization of fixed assets, cost adjustments, and the additional income earned outside normal business operations.

Our sample consists of 51 conventional firms and 26 producer cooperatives in the construction industry. Data on producer cooperatives cover the 1981–1988 period, while the conventional firm sample runs from 1981 to 1989. Availability of data is the reason for the slightly different time periods. As such the overall size of the data set compares very favorably with data sets used in previous work.

In [Table 1](#) we report descriptive statistics separately for producer cooperatives and conventional firms for those observations used in the econometric analysis.<sup>14</sup> On an average, conventional firms employ only slightly more workers, use more capital per worker, and pay their employees better than the cooperatives in our sample.<sup>15</sup> [Zevi \(1982\)](#) and [Bartlett, Cable, Estrin, Jones, and Smith \(1992\)](#) also reported that conventional firms were more capital intensive than producer cooperatives.

The descriptive statistics for cooperatives reveal important features of how workers participate in the firms. Turning first to our indicator of participation in decision making (MEMB), we find that 77% of the permanent

**Table 1.** Summary Statistics.

	Cooperatives		Conventional Firms	
	Mean	St. dev.	Mean	St. dev.
<i>Q</i>	20,980	17,291	32,433	30,979
<i>L</i>	562	493	677	735
<i>K</i>	18,177	14,723	28,941	29,365
<i>KL</i> ratio ( <i>K/L</i> )	34.8	13.3	46.8	21.5
(Labor costs)/ <i>L</i>	28.8	4.0	38.3	9.5
BONUS	0.07	0.29		
MEMB	0.77	0.13		
OWN	2.23	1.39		
LEND	11.67	5.79		
RES	46.30	30.74		
Number of firms	26		51	
Time period	1982–1988		1982–1989	
Number of observations	138		236	

*Notes:* All variables are defined in the Appendix. All values are in millions of lire and are in constant 1985 prices.

employees, on an average, are members. This is at least as high as the average participation rate in the cooperatives in France, Italy, and the United Kingdom studied by *Estrin, Jones, and Svejnar (1987)*. There are only four sample observations (corresponding to two cooperatives) for which members accounted for fewer than 50% of the cooperative's permanent employees; there is only one observation for which all permanent employees were members. Although cooperatives in our sample employed hired workers, their (permanent) workforce consisted predominately of worker-members.

In contrast to decision-making participation, financial participation appears to be much weaker. The average bonus, distributed to all workers, is small.<sup>16</sup> Indeed, in more than 90% of the observations the cooperative does not pay a bonus.<sup>17</sup> When workers received a bonus payment, it equalled, on average, only 3% of average labor costs per worker and was less than 7% of average labor costs for all observations in our sample. We suspect that the infrequency of bonus payments and their small fraction of compensation partly reflect the difficult time experienced by construction cooperatives in the 1980's (*Earle, 1986*). Since we lack data on profit sharing by conventional firms, we assume that they did not distribute a bonus to their workers. This assumption is consistent with the survey evidence reported in *Uvalic (1990)* that indicates that few conventional Italian firms (across all industries) distributed bonuses to their workers during the 1984–1987 period. However, profit sharing apparently increased in 1988 as the Italian economy improved. The individual ownership stake of worker-members (OWN) is quite modest compared to collective reserves per worker member (RES). This partly reflects various institutional forces previously described, notably the requirement that at least 20% of profits be allocated to a legal reserve fund and the exemption from corporate income tax of profits allocated to funds such as collective reserves (*Zevi, 1982*), and the ceiling on the rate of interest that can be paid on individual capital stakes, while loans can pay a higher rate (*Zevi, 1982*).<sup>18</sup> In addition to the different rates of return on loans and equity, a second reason why LOAN is on average higher than OWN is that our data for loans includes loans from both current worker members and other members (e.g., former workers).

## **5. EMPIRICAL FRAMEWORK**

Our empirical strategy is to estimate translog production functions that capture the effects of differences in the organizational structures of

cooperatives and conventional firms in a variety of ways.<sup>19</sup> In some specifications, these differences are only allowed to directly affect output, while in other specifications the organizational form is also allowed to affect some or all of the coefficients on the labor and capital input variables. Our most general translog specification is given by

$$\begin{aligned} \ln Q_{it} = & \alpha_i + \alpha_t + \alpha_{Ct} + \beta_L \ln L_{it} + \beta_K \ln K_{it} + \beta_{LL}(\ln L_{it})^2 \\ & + \beta_{KK}(\ln K_{it})^2 + \beta_{LK}(\ln L^* \ln K)_{it} + \beta_1 \text{BONUS}_{it} \\ & + \beta_2 \text{MEMB}_{it} + \beta_3 \text{OWN}_{it} + \beta_4 \text{RES}_{it} + \beta_5 \text{LEND}_{it} \\ & + \beta_{LC} \text{COOP}^* \ln L_{it} + \beta_{KC} \text{COOP}^* \ln K_{it} + \varepsilon_{it} \end{aligned} \quad (1)$$

where  $Q$  is output (real value added),  $L$  is employment,  $K$  is the capital stock, **BONUS** is the average distributed profit per employee, **MEMB** is the proportion of permanent employees who are worker members, **OWN** is the average capital stake of worker members, **RES** is average collective reserves per worker member, **LEND** is the average loan capital per worker member, **COOP** is a dummy variable for producer cooperatives,  $\alpha_i$  is the firm-specific fixed effect,  $\alpha_t$  is the time effect for conventional firms,  $\alpha_t + \alpha_{Ct}$  is the time effect for cooperatives, and  $\varepsilon_{it}$  is the disturbance term. (See Appendix for more detailed definitions of the variables.) We assume that  $\varepsilon_{it}$  is independently distributed (across firms and over time), but is possibly heteroskedastic. One source of heteroskedasticity is that value added for conventional firms and cooperatives are not necessarily calculated in the same way. In particular, the adjustments made by Mediobanca in computing value added might be thought of introducing measurement error that might inflate the variance of the disturbance terms of conventional firms.

We include firm-specific effects ( $\alpha_i$ ) to capture the time-invariant heterogeneity of the firms in our sample. In particular, the firm-specific intercepts will attempt to control for differences among firms such as managerial abilities and worker quality. Additionally, as we will discuss below, the effect upon output that is common to all cooperatives might be captured by the firm-specific effects. The time effects capture technological change and other shocks that are common to all conventional firms ( $\alpha_t$ ) and to all cooperatives ( $\alpha_t + \alpha_{Ct}$ ) in the industry.

We include five variables, **BONUS**, **MEMB**, **OWN**, **RES**, and **LEND**, to capture how variations in financial and decision-making participation directly affect output.<sup>20</sup> These measures have been used in previous studies of the technical efficiency of producer cooperatives such as Jones and Svejnar (1985) and Estrin et al. (1987).<sup>21</sup> Following Ben-Ner and Jones (1995), the inclusion of the five measures of participation assumes that the productive

efficiency of cooperatives varies *both* with the degree of financial *and* the extent of decision-making participation.

Alternatively, one might assume that the five participation measures at best help capture variation in productive efficiency only within the cooperative segment of the industry, but that additionally, all cooperatives are fundamentally different than conventional firms. While it might be desirable to include a dummy variable (COOP) to capture the systematic common difference between cooperatives and conventional firms which directly affect output (as opposed to altering the effects of input changes on output), it is not possible when we include the firm-specific fixed effects unless we impose restrictions on the  $\alpha_i$ 's and the coefficient on COOP.<sup>22</sup> Hence, to examine whether there is a common systematic difference between cooperatives and conventional firms, we include COOP and impose the restriction that the coefficient on COOP equals the difference between the average value of the firm-specific fixed effects for cooperatives and the average value for conventional firms. Since our sample of firms includes most of the population of large construction firms, the coefficient on COOP might be a good indicator of a systematic difference between cooperatives and conventional firms.

The interaction terms involving the dummy variable, COOP, as defined above, and the input variables allow for changes in input levels in cooperatives to affect output differently than in conventional firms. In light of the modest size of our sample of cooperatives, it would be asking too much from the data to indicate how all five coefficients of the translog production function differ between cooperatives and conventional firms, i.e., to also interact COOP with  $(\ln L)^2$ ,  $(\ln K)^2$ , and  $(\ln L \cdot \ln K)$ .<sup>23</sup> Thus, we consider a less ambitious specification in which COOP is interacted only with  $\ln L$  and  $\ln K$ , thereby allowing the output elasticities of labor and capital to differ for cooperatives and conventional firms.<sup>24</sup>

Additionally, the coefficients on COOP\* $\ln L$  and COOP\* $\ln K$  indicate if the productivity difference between cooperatives and conventional firms is affected by the size of the firm's labor force and its capital intensity.<sup>25</sup> Group incentives such as profit sharing are expected to be less effective in larger firms where the free rider problem would be more acute (Cable & Wilson, 1990). Larger firms might realize smaller productivity gains from worker participation in decision making because of the difficulties in providing information to and in reaching agreements among many decision makers.<sup>26</sup> Insofar as a large capital stock is an indicator of machine-paced production, one would expect small productivity gains from participation (Brown, 1990; Cable & Wilson, 1990). Our production function given by Eq. (1) implies that if a cooperative and a conventional firm used the same amounts of

labor and capital, then output of the cooperative would be proportionally greater than output of the conventional firm by

$$\ln Q_1 - \ln Q_0 = \beta_1 \text{BONUS} + \beta_2 \text{MEMB} + \beta_3 \text{OWN} \\ + \beta_4 \text{RES} + \beta_5 \text{LEND} + \beta_{LC} \ln L + \beta_{KC} \ln K \quad (2)$$

where  $Q_1$  and  $Q_0$  are output of the cooperative and conventional firm respectively. We can transform Eq. (2) to express the output of the cooperative relative to that of the conventional firm as a function of firm size ( $L$ ) and capital intensity, i.e.,

$$\ln Q_1 - \ln Q_0 = \beta_1 \text{BONUS} + \beta_2 \text{MEMB} + \beta_3 \text{OWN} + \beta_4 \text{RES} + \beta_5 \text{LEND} \\ + (\beta_{LC} + \beta_{KC}) \ln L + \beta_{KC} \ln(K/L) \quad (3)$$

Thus,  $\beta_{KC}$  indicates the effect of capital intensity on the productive efficiency of the cooperative holding firm size constant, and  $(\beta_{LC} + \beta_{KC})$  indicates the effect of firm size holding capital intensity constant.

For each specification, we estimate production functions by ordinary least squares (OLS) and by an instrumental variables (IV) procedure to account for the endogeneity of labor, the capital stock, and contemporaneous measures of financial and decision-making participation (except for the lagged value of BONUS, which will be assumed to be predetermined). We will treat COOP as a predetermined variable. The two variables that involve the interaction of COOP with  $\ln L$  and  $\ln K$  are explanatory variables that are endogenous over part of the sample and predetermined over the remaining observations. (Specifically, observations on one of these variables will be predetermined whenever the observation corresponds to a conventional firm.) To obtain consistent estimates, we treat these interaction terms as endogenous variables.

As Keane and Runkle (1992) note, predetermined variables are not legitimate instruments to use to estimate a fixed effects model when you have short panels (i.e., when the asymptotic properties of estimators, such as consistency, are derived for large  $N$  and fixed  $T$ ). To obtain consistent estimates with our IV, which include lagged values of endogenous variables, Eq. (1) is first differenced to eliminate the firm-specific fixed effects and then this equation is estimated by two-stage least squares using instruments that include the second lags of the endogenous variables<sup>27</sup> (Anderson & Hsiao, 1981). These predetermined variables are legitimate instruments used to estimate the first difference equation. However, the disturbance term of the first differenced equation ( $\varepsilon_{it} - \varepsilon_{it-1}$ ) is a moving average process, which implies that the IV estimates are consistent but their estimated standard errors

need not be consistent. We attempt to correct for this by computing standard errors that are robust to both heteroskedasticity and a first-order moving average process.<sup>28</sup>

## 6. EMPIRICAL RESULTS

Tables 2 and 3 report the OLS and IV estimates of translog production functions that capture the effects of worker participation in different ways.<sup>29</sup> For purposes of exploring the data, we start with a simple model that omits the firm fixed effects and includes a simple COOP dummy to capture the difference in technical efficiency between cooperatives and conventional firms. In the results reported in the first column of Table 2 we see that the estimated coefficient suggests that cooperatives are approximately 17% less efficient than conventional firms. However, our fixed effect OLS results, as reported in the remaining columns of Table 2, indicate that the fixed effects are statistically significant. Therefore, it is these results that we will focus on.

In contrast to the implications drawn from some previous econometric work, we do not always find that the productivity of cooperatives is significantly higher than for conventional firms. Our point estimates (when evaluated at the sample means of our cooperatives) indicate that the productivity of cooperatives is lower than conventional firms,<sup>30</sup> except in models containing interaction terms that allow the output elasticities to differ across types of firms and when we assume that there is no systematic difference between cooperatives and conventional firms captured by the firm-specific fixed effects. Moreover, these estimated productivity differences are often statistically significant and quite large. These models that omit the interaction terms involving  $\ln L$  and  $\ln K$  and COOP, and reported in columns 2, 4, and 6 of Table 2, thus imply that productivity in cooperatives is at least 20% lower than in conventional firms, assuming that the two types of firms use the same amount of capital and labor.

However the picture that emerges from the results for the three interaction terms is different.<sup>31</sup> When the average difference of the firm fixed effects is assumed to reflect the organizational form of the firm, a negative and significant productivity differential in favor of conventional firms is again implied. By contrast, under the assumption that the fixed effects capture firm differences that are unrelated to organizational form, we calculate that the productivity differential is now positive, but insignificant. (The positive estimated differential reflects the large positive coefficient on COOP\* $\ln L$ .)



**Table 2.** OLS Estimates of Translog Production Functions.

$\ln L$	0.80 (1.35)	1.83 (1.82)	1.38 (1.28)	1.84 (1.80)	1.40 (1.29)	1.99 (2.13)	1.43 (1.38)
$\ln K$	-0.19 (0.29)	-0.89 (1.28)	-0.65 (0.90)	-0.92 (1.37)	-0.71 (0.96)	-0.96 (1.43)	-0.71 (1.00)
$(\ln L)^2$	0.01 (0.17)	0.14 (1.27)	0.09 (0.73)	0.13 (1.24)	0.08 (0.71)	0.16 (1.85)	-0.10 (0.96)
$(\ln K)^2$	0.02 (0.31)	0.17 (1.87)	0.12 (1.29)	0.16 (1.85)	0.13 (1.30)	0.18 (2.36)	0.13 (1.49)
$\ln L * \ln K$	-0.02 (0.14)	-0.31 (1.22)	-0.20 (1.17)	-0.30 (1.56)	-0.20 (0.95)	-0.36 (2.19)	-0.22 (1.17)
COOP	-0.17 (2.70)	0.17 (0.70)	-0.55 (0.41)	0.16 (0.65)	-0.65 (0.50)	-0.03 (0.42)	-0.78 (0.58)
COOP* $\ln L$			0.38 (2.32)		0.39 (2.38)		0.38 (2.26)
COOP* $\ln K$			-0.20 (1.17)		-0.19 (1.14)		0.36 (0.94)
BONUS		0.04 (1.13)	0.03 (0.89)				
BONUS $_{T-1}$				-0.01 (0.17)	-0.02 (0.41)		
MEMB		-0.19 (0.85)	0.02 (0.12)	-0.17 (0.72)	0.05 (0.24)		
OWN		-0.02 (0.83)	-0.01 (0.55)	-0.02 (0.90)	-0.01 (0.56)		
RES		-0.007 (5.87)	-0.006 (5.74)	-0.007 (5.90)	-0.006 (5.86)	-0.007 (6.10)	-0.006 (6.52)
LEND		-0.0008 (0.14)	0.003 (0.54)	-0.001 (0.22)	0.003 (0.49)		

*Notes:* (1) Absolute values of  $t$  statistics are in parentheses. These statistics are computed using heteroskedastic consistent standard errors; (2) All models except the first include firm-specific fixed effects. The estimated time effects for conventional firms and for cooperatives are not reported.

**Table 3.** IV Estimates of Translog Production Functions.

$\ln L$	1.95 (0.60)	4.97 (0.81)	2.11 (0.66)	5.42 (0.88)
$\ln K$	2.21 (0.58)	-0.32 (0.07)	2.12 (0.56)	-0.81 (0.16)
$(\ln L)^2$	-0.06 (0.14)	-0.17 (0.22)	-0.02 (0.04)	-0.11 (0.13)
$(\ln K)^2$	-0.11 (0.34)	0.01 (0.03)	-0.08 (0.24)	0.07 (0.16)
$\ln L * \ln K$	-0.05 (0.08)	-0.22 (0.22)	-0.12 (0.20)	-0.33 (0.32)
COOP				
COOP* $\ln L$		-0.17 (0.13)		-0.26 (0.19)
COOP* $\ln K$		1.87 (0.74)		1.99 (0.77)
BONUS	-0.13 (0.54)	-0.12 (0.44)		
BONUS $_{T-1}$			-0.06 (0.66)	-0.07 (0.56)
MEMB	0.63 (0.58)	0.19 (0.15)	0.80 (0.77)	0.34 (0.27)
OWN	-0.01 (0.11)	-0.03 (0.30)	-0.003 (0.03)	-0.03 (0.26)
RES	-0.007 (1.11)	-0.01 (0.44)	-0.007 (1.17)	-0.01 (2.05)
LEND	0.04 (1.05)	0.01 (0.19)	0.04 (0.98)	0.01 (0.13)

*Notes:* (1) Absolute values of asymptotic  $t$  statistics are in parentheses. These statistics are computed using the Newey–West estimator based on autocorrelation of one period to obtain consistent standard errors; (2) Coefficient estimates are obtained by first differencing the translog production function and estimating the first differenced model by two-stage least squares. All models include separate time effects for conventional firms and cooperatives. The estimated time effects for conventional firms and for cooperatives are not reported.

The models that include measures of financial and decision-making participation potentially help identify the sources of the productivity differences. However, except for RES, none of the individual measures of participation is significant in any of the specifications. RES is always negative and significant. Moreover, the estimated effect of RES on output is quite substantial in all cases.<sup>32</sup> However, as Bonin et al. (1993) note, the motivation for including a measure of collective ownership is that it indicates the disincentives to undertake investment projects. While this implies that cooperatives will be less capital intensive than conventional firms (as our descriptive statistics show), our measure of technical efficiency is based on both types of firms using the same amounts of both inputs.<sup>33</sup> Thus, we find the importance of RES surprising. The small and infrequent bonuses distributed by cooperatives likely accounts for our failure to confirm most previous work, which finds profit sharing to be positive and significant in cooperatives.

Turning to the models that allow the productivity difference between cooperatives and conventional firms to vary with firm size and capital intensity, we find that COOP\* $\ln L$  is always positive and significant, while COOP\* $\ln K$  is negative and insignificant. However, the estimated difference in the output elasticity of labor is perhaps implausibly large.<sup>34</sup> The insignificant coefficient on COOP\* $\ln K$  implies that productivity does not

vary with the cooperatives capital intensity, while the estimated effect of firm size on productivity, holding capital intensity constant, is positive and insignificant.

While the IV results reported in Table 3 are not terribly strong, they each imply positive productivity differentials in favor of cooperatives. However, the estimated differentials are implausibly large (e.g., implying cooperatives are twice as productive as conventional firms), and many coefficients are imprecisely estimated. The only measure of participation that is statistically significant is again collective reserves,<sup>35</sup> but only in models that include the interaction terms  $-\ln L^*COOP$  and  $\ln K^*COOP$ . However, cooperatives are estimated to have an implausibly higher output elasticity of capital than conventional firms so these estimated specifications appear to be very reliable. While the coefficients of some participation measures such as MEMB are fairly large, both the Newey–West and uncorrected standard errors indicate that they are not precisely estimated.

## 7. CONCLUSION

Since both theoretical and empirical evidence is inconclusive concerning the comparative performance of LMFs and conventional firms, we assembled new data for a sample of Italian firms. We estimated production functions for the Italian construction industry using a panel of producer cooperatives and conventional firms. We are fortunate that the data we use have a number of advantages over data used in previous studies. Except for organizational form, the cooperatives in our sample are fairly comparable to our conventional firms: average employment is roughly the same, both types of firms likely were formed as new firms rather than as restructured bankrupt firms,<sup>36</sup> and most firms were formed prior to the sample period.<sup>37</sup> While the capital intensity of cooperatives was lower than conventional firms, this seems to be fairly typical and may reflect the alleged tendency of cooperatives to invest less than conventional firms.

We find that translog production function estimates are preferred to the Cobb Douglas estimates. Based on these translog estimates, and unlike several previous econometric studies, we find no consistent evidence of significant productivity differences between cooperatives and conventional firms. While many OLS point estimates indicate that output would be lower in a cooperative than in an otherwise identical conventional firm, this is not the case in our IV estimates. The only statistically significant measure of financial and decision-making participation is collective reserves.

We conclude by first discussing some possible explanations for why our results differ somewhat from many previous findings, especially those for Italian producer cooperatives. First, there were a number of mergers involving producer cooperatives in the construction industry beginning in the late 1970s (Zevi, 1982). Many of these mergers were encouraged by cooperative associations (e.g., Lega) to save weaker cooperatives. Clearly, the absorption of weaker cooperatives may have lowered the productivity of financially stronger ones.<sup>38</sup> Second, managers are often paid less than their conventional firm counterparts (Holmstrom, 1989) and are often prevented from becoming members by a limit of 12% of total membership that can be accounted for by technical and administrative workers (Zevi, 1982). Both factors might contribute to less efficient supervision than found in conventional firms.<sup>39</sup> Third, we were able to construct a measure of distributed bonuses, while Jones and Svejnar (1985) were forced to use profits per worker to capture the effects of profit sharing in their study of Italian producer cooperatives. In light of the infrequency in which our cooperatives distributed profits to its workers, profits per worker is a poor proxy during our time period.<sup>40</sup> It is unclear to what degree previous results for Italian cooperatives based upon this proxy are spurious. Fourth, conventional construction firms and cooperatives might be systematically operating in different segments of the market and undertaking fundamentally different types of construction projects. Thus, our estimated productivity effects might be capturing differences in the firms' economic environments rather than the efficiency with which firms use labor and capital.<sup>41</sup> Finally, the average labor force of the cooperatives we studied is typically larger than cooperatives studied in most previous econometric work. Perhaps the productivity gains of cooperatives only characterize smaller firms?<sup>42</sup>

More generally, since the productive efficiency of cooperatives will likely vary across institutional settings (Jones & Pliskin, 1991a) and time periods, then it is perhaps not surprising that we found cooperatives to be less productive than conventional firms. Of course, this suggests that one element in future research would be to focus on identifying the institutional settings that are favorable to cooperatives. And a body of useful work is in process on this matter.<sup>43</sup>

In addition, arguably before firm conclusions can be reached, new research methods need to be applied to the question of the comparative performance and the like. We arrive at this view because of findings that emerge from recent theoretical and empirical developments. Concerning theory, theoretical work clearly shows how economic performance can be expected to be strongly affected by diverse human resource policies (HRPs), such as

mechanisms designed to foster employee involvement and alternative forms of compensation. (see, e.g. Lazear, 2000; Prendegast, 1999) and not just key structural aspects of organizational form (such as cooperative versus private ownership). Moreover, empirical studies of participatory capitalist firms, which include measures of programs including different kinds of compensation system and various kinds of teams, affirm that diverse HRPs matter much for firm performance (see, e.g., Ben-Ner, Burns, Dow, & Putterman, 2000; Kruse et al., 2004). In other words, since the data used in our study of Italian firms in construction is restricted to include measures only of those HRPs that emanate from organization form, such as membership ratios and measures of collective reserves in Coops, it is possible that our study omits important variables and thus is compromised by severe measurement issues. Moreover, it is quite possible that the set of HRPs that existed in the average Italian cooperative in construction during the study period was less likely to enhance performance than was the comparable set of policies in place in conventional firms. Or even if formal HRPs were comparable across the two sets of firms, it is possible that they may have been implemented more poorly in PCs and thus their effectiveness dissipated more rapidly than in conventional firms. While we do not have direct evidence for such conjectures, we note that for other PCs there is some evidence that HRP practices have been found to be less innovative when compared with capitalist firms in similar industries. For example, Greenberg (1986) reports how participatory structures in plywood PCs paid far less attention to safety issues than did conventional plywood mills. In addition, we note that there is evidence for Italy as for other parts of Europe that during this period practices that provided for employee involvement such as teams and participation in enterprise rewards were spreading fast; we expect that the rate of adoption for at least some of these practices might have been happening at a faster rate in conventional firms than in PCs (see, e.g., Uvalic, 1990). Potentially this point has significant implications for research design: in order to confidently assess the comparative performance of PCs and conventional firms we need to augment what is already a fairly daunting set of data requirements (see Bonin et al., 1993) to also include information on the full sets of relevant HRPs in both organizations, such as teams, QCs, safety committees, and alternative forms of compensation. Unless this is done, such studies necessarily must suffer from measurement error that may be expected to be quite large, and thus confound any estimated difference in technical efficiency that emerges from specifications that exclude key HRP variables.

In tandem with this proposed more expansive firm-level research design, other recent work suggests that more reliable evidence also requires that

econometric case studies should also be undertaken.<sup>44</sup> Arguably the reliability of evidence on relationships between HRP<sub>s</sub> and enterprise outcomes may be questioned in studies that employed simple firm-level measures of HRP<sub>s</sub>, and yet firms had multiple plants (and possibly variation in HRP<sub>s</sub> within firms). Relatedly, the use of firm-level data has meant that empirical work is necessarily limited in its ability to provide appropriate tests of some hypotheses – e.g., an inability to gauge the impacts of HRP<sub>s</sub> on product quality when firms produce heterogeneous products. Conducting insider econometric studies where the impact of HR events (e.g., Freeman & Kleiner, 2005) or variation in HRP<sub>s</sub> within a plant (e.g. Hamilton, Nickerson, & Owan, 2003) is needed to furnish additional reliable information. Until findings from such a twin-pronged research strategy emerge – matched econometric case studies in tandem with a more expansive research design for firm-level studies that includes data for full sets of HRP<sub>s</sub> – it is likely that the empirical picture concerning issues surrounding the comparative performance of capitalist firms and PC<sub>s</sub> will remain blurred.

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## NOTES

1. See, for example, recent editions of *Advances in the Economic analysis of Participatory and Labor-Managed firms* such as Kalmi and Klinedinst (2006).
2. See Bonin et al. (1993), Jones and Pliskin (1991a), and Dow (2003) for surveys.
3. For example, see Zevi (1982), George (1982), and Bartlett et al. (1992).
4. For example, see Defourny, Estrin, and Jones (1985), Estrin and Jones (1995), Estrin et al. (1987), and Jones and Svejnar (1985). Some exceptions are Jones (1987), Lee (1988), Berman and Berman (1989), Estrin (1991), and Craig and Pencavel (1995).
5. While the estimated coefficient on the dummy variable for cooperatives in the production function estimated over the pooled sample indicated that cooperatives were less productive than conventional firms, this result may be suspect because a

Chow test rejected the hypothesis that the parameters of the production functions of the two types of firms were identical.

6. Since the remaining firms either had profit-sharing plans or employee stock ownership plans, the sample did not include conventional firms that did not offer financial participation.

7. While his results showed that cooperatives in both industries were characterized by less severe decreasing returns to scale, it was not possible to estimate their relative technical efficiency.

8. Good accounts include those by Ammirato (1996), Earle (1986), Holmstrom (1989), and Zevi (1982).

9. Thus what a member receives bears no relation to the enterprises's net returns. In no way can the individual capital contributions be considered as the market membership price that is envisaged by some theorists of the LMF.

10. These firms were among the 1,500 or so largest manufacturing, service and trading firms ranked on the basis of sales. (The number of firms in a given year was based on a sales threshold and varied between 1,115 and 1,765 firms.)

11. The regressions for real value added, real fixed assets, and real profits were based on 24 observations, while those for labor and real labor costs were based on 23 observations because of missing data. Some observations were not included in our econometric analysis discussed in Section 4 because of missing data on labor or on one of the measures of participation. However, we use these observations to help assess how well the data from the two sources correspond.

12. As an additional check of the consistency of the two data sets, in unreported regressions we used the Mediobanca employment data rather than the cooperative figures for employment. The results obtained using this procedure are essentially unaltered from those reported in the empirical section below.

13. Using the 24 common observations on the seven cooperatives, the mean of the natural logarithm of value added calculated from the cooperative data set exceeded the corresponding mean from the Mediobanca data set by .032. Average real value added was 39,801 million 1985 lire for the 24 observations from the cooperative data set and 39,158 million lire for the corresponding Mediobanca observations, a difference of 1.6%.

14. The time period for both samples begins in 1982 because observations for 1981 are lost by our use of lagged values of some variables as instruments.

15. As a referee pointed out, the higher wages in conventional firms could be due to different occupational structures or, if wages were higher for similar skill levels, this might reflect payment of efficiency wages.

16. Bonus is defined to be transfers to both member and nonmembers divided by total employment. Transfers include payments to members and nonmember workers both before and after settlement of profits. Chillemi and Gui (1992) apparently computed their measures of profit sharing in a similar manner. We divide transfers by employment rather than the number of worker-members because as Zevi (1982) notes, workers who are not members share equally in the transfers in many cooperatives.

17. Chillemi and Gui (1992) reported that many of the Italian cooperatives in their sample did not distribute a bonus. Also, see Uvalic (1990) which cites survey evidence that shows no profit sharing by Italian cooperatives in all industries from 1984 to 1987.

18. Note that the law capping dividends on shares in Italian Coops was changed during the 1990s. However, for the period covered by this study, a ceiling was still operative.

19. F tests lead us to prefer the translog form over the Cobb–Douglas form. Also, based on our calculations for critical parameters such as the marginal product of capital, we find that the translog estimates do yield meaningful production functions. (This has not always proved to be the case with work in this field. See, for example, [Craig & Pencavel, 1995, p. 147.](#))

20. We consider alternative specifications in which the lagged value of BONUS is used in place of the current value. The lagged value of BONUS may best capture the incentives provided by sharing profits with workers because these payments are determined within the year or while drafting the balance sheet ([Chillemi & Gui, 1992](#)).

21. As noted above, these studies were based on samples that did not contain conventional firms and the relative technical efficiency of cooperatives was assumed to reflect the extent to which their workers participated financially and in the making of decisions.

22. [Estrin \(1991\)](#) captures the productivity effect of cooperatives using only a coop dummy variable. He is able to do so because none of his specifications include firm-specific fixed effects.

23. If we allow for the variance of the disturbance term to differ between cooperatives and conventional forms, this would be equivalent to estimating separate translog production functions for cooperatives and conventional firms.

24. For example, the output elasticity of labor is given by  $\beta_L + 2\beta_{LL}\ln L + \beta_{LK}\ln K + \beta_{LC}\text{COOP}$ , implying that  $\beta_{LC}$  indicates the difference in output elasticities.

25. In their studies of the productivity effect of alternative forms of compensation, [Cable and Wilson \(1989, 1990\)](#) and [Wadhvani and Wall \(1990\)](#) allow their profit sharing dummy variables to affect the output elasticities of labor and capital in their Cobb–Douglas specifications. In their study of the productivity effects of profit sharing and worker participation, [Jones and Pliskin \(1991b\)](#) adapted this approach to translog production functions.

26. For example, [Holmstrom \(1989\)](#) discusses the efforts of the largest worker cooperative, CMC of Ravenna, to decentralize decision making to cope with difficulties arising from its size.

27. In addition to the time effects, we use  $\ln L_{t-2}$ ,  $\ln K_{t-2}$ ,  $(\ln L)^2_{t-2}$ ,  $(\ln K)^2_{t-2}$ ,  $(\ln L * \ln K)_{t-2}$ , the second lags of the five measures of financial and decision-making participation, the natural logarithm of real value added, the natural logarithm of real labor costs per worker, real profits and all these variables interacted with COOP. A rationale for interacting these variables with the dummy variable for cooperatives is that even if conventional firms and cooperatives do not differ in technological efficiency, they may respond differently to changes their economic environment. [Craig and Pencavel \(1992\)](#) and [Pencavel and Craig \(1994\)](#) report that following changes in output and input prices, U.S. plywood cooperatives adjust their output and employment differently than do conventional plywood firms.

28. We computed robust standard errors using a procedure based on [Newey and West \(1987\)](#). However, this procedure is not satisfactory in our case because it ignores the panel nature of our data.



29. The OLS results are based on 374 observations, while the IV results are based on 293 observations. The difference reflects the loss of observations when we compute first differences: we lose at least one observation for each of the 77 firms. While the OLS, fixed effects sample may appear to be larger, we are also estimating 77 additional parameters – the  $\hat{\tau}$ s. Thus, the degrees of freedom of corresponding specifications are nearly the same.

30. Estrin found that Italian cooperatives are significantly less productive than conventional firms when hours worked by blue collar was the measure of labor input. Moreover, the estimated differential was quite large – roughly 28–38%. However, he did not find a significant productivity effect when labor was measured by total employment.

31.  $F$  tests lead us to prefer these specifications with interactions.

32. This effect is based on comparing a firm with RES equal to its mean in the cooperative sub-sample with a firm in which RES equals 0. A referee points out that this finding could be due to the existence of a positive relationship between collective reserves and coop age. While, regrettably, we do not have comprehensive data with which to investigate this conjecture, we do know cooperative age for two firms. For these firms, which we believe are above average age, collective reserves are considerably above average.

33. The underinvestment hypothesis as Bonin et al. (1993) state is one concerned with allocative efficiency rather than “factor productivity.”

34. Recall that these coefficients indicate the difference between cooperatives and conventional firms in their output elasticities of labor and capital.

35. For these two models, RES is significant only when we use the Newey–West standard errors. The “uncorrected” imply asymptotic  $t$  statistics of around 1.

36. This is based on what is typical for producer cooperatives in the Italian construction industry rather than the histories of the 25 cooperatives in our sample.

37. Since the firms are fairly large, it is unlikely that they are new firms. In addition, we excluded observations on any conventional firm from the sample when it was reported that it was involved in an acquisition or merger and its assets changed appreciably from the previous year.

38. Mergers of consumer cooperatives in other nations (e.g., United Kingdom and Sweden) apparently had a similar effect on the combined cooperative.

39. Craig and Pencavel (1993) report that some hired managers of U.S. plywood cooperatives have complained about interference from members.

40. When we replaced BONUS by profits per worker, the coefficient on this variable was positive and statistically significant.

41. Chillemi and Gui (1992) argue that studies of cooperatives need to distinguish between economic and technical efficiency. Moreover, we note that since the period examined in this study, Italian cooperatives appear to have continued to flourish. This contrasts with some other cases, notably the plywood Coops which, notwithstanding their apparent productivity edge have virtually disappeared.

42. However, this hypothesis was not confirmed by our econometric results for models that included COOP\*ln  $L$ . Also, Estrin (1991) did not find that the productivity of small cooperatives in light manufacturing industries differed from comparable conventional firms.

43. Smith (1994) reports evidence that Italian industrial cooperatives are relatively more efficient when they produce high quality products, use corporate alliances, and when its innovative activity is based on knowledge produced by its workers.

44. For a discussion and examples of this method see Jones, Kalmi, and Kauhanen (2006).

## REFERENCES

- Alchian, A., & Demsetz, H. (1972). Production, information costs, and economic organization. *American Economic Review*, 62, 777–795.
- Ammirato, P. (1996). *La Lega: The making of a successful co-operative network*. Aldershot: Dartmouth Publishing Company.
- Anderson, T. W., & Hsiao, C. (1981). Estimation of dynamic models with error components. *Journal of the American Statistical Association*, 76(375), 598–606.
- Bartlett, W., Cable, J., Estrin, S., Jones, D., & Smith, S. (1992). Labour-managed cooperatives and private firms in North Central Italy: An empirical comparison. *Industrial Labor Relations Review*, 46, 103–118.
- Ben-Ner, A., & Jones, D. C. (1995). Employee participation, ownership and productivity: A theoretical framework. *Industrial Relations*, 34(4), 532–554.
- Ben-Ner, A., Burns, W. A., Dow, G., & Putterman, L. (2000). Employee ownership: An empirical exploration. In: M. Blair & T. Kochan (Eds), *The new relationship: Human capital in the American corporation* (pp. 194–240). Washington, DC: Brookings.
- Berman, K., & Berman, M. (1989). An empirical test of the theory of the labor-managed firm. *Journal of Comparative Economics*, 13, 281–300.
- Bonin, J., Jones, D., & Putterman, L. (1993). Theoretical and empirical studies of producer cooperatives: Will the twain ever meet? *Journal of Economic Literature*, 31, 1290–1320.
- Brown, C. (1990). Firm's choice of method of pay. *Industrial Labor Relations Review*, 43, 165–182.
- Cable, J., & Wilson, N. (1989). Profit sharing and productivity: An analysis of UK engineering firms. *Economic Journal*, 99, 366–375.
- Cable, J., & Wilson, N. (1990). Profit sharing and productivity: Some further evidence. *Economic Journal*, 100, 550–555.
- Chillemi, O., & Gui, B. (1992). On the performance of worker managed firms: Does participation only exert “technical” effects? *Journal of Comparative Economics*, 16, 294–301.
- Conte, M., & Svejnar, J. (1988). Productivity effects of worker participation in management, profit-sharing, worker ownership of assets and unionization in U.S. Firms. *International Journal of Industrial Organization*, 6, 139–151.
- Craig, B., & Pencavel, J. (1992). The behavior of worker cooperatives: The plywood cooperatives of the Pacific Northwest. *American Economic Review*, 82, 1083–1105.
- Craig, B., & Pencavel, J. (1993). The objectives of worker cooperatives. *Journal of Comparative Economics*, 17, 288–308.
- Craig, B., & Pencavel, J. (1995). Participation and productivity: A comparison of worker cooperatives and conventional firms in the plywood industry. In: *Brookings papers on economic activity: Microeconomics* (pp. 121–174). Washington, DC: Press.

- Defourny, J., Estrin, S., & Jones, D. (1985). The effects of workers' participation on enterprise performance. *International Journal of Industrial Organization*, 3, 197–217.
- Doucouliaqos, C. (1995). Worker participation and productivity in labor-managed and participatory capitalist firms: A meta-analysis. *Industrial and Labor Relations Review*, 49(1), 58–77.
- Dow, G. (2003). *Governing the firm: Workers control in theory and practice*. Cambridge: Cambridge University Press.
- Earle, J. (1986). *The Italian cooperative movement*. London: Allen & Unwin.
- Estrin, S. (1991). Some reflections on self-management, social choice, and reform in Eastern Europe. *Journal of Comparative Economics*, 15, 349–366.
- Estrin, S., & Jones, D. C. (1995). Why workers want participation and ownership and their effects upon productivity. *Advances in the economic analysis of participatory and labor managed firms* (Vol. 5, pp. 3–24). Greenwich Conn.: JAI Press.
- Estrin, S., Jones, D. C., & Svejnar, J. (1987). The productivity effects of worker participation: Producer cooperatives in Western economies. *Journal of Comparative Economics*, 11, 40–61.
- Fitzroy, F., & Kraft, K. (1987). Cooperation, productivity and profit sharing. *Quarterly Journal of Economics*, 102, 23–35.
- Freeman, R., & Kleiner, M. (2005). The last American shoe manufacturers: Decreasing productivity and increasing profits in the shift from piece rates to continuous flow production. *Industrial relations*, 44(2), 307–330.
- George, D. (1982). Workers' co-operatives in Denmark. *Managerial and Decision Economics*, 3, 205–212.
- Greenberg, E. (1986). *Workplace democracy*. Ithaca: Cornell University Press.
- Hamilton, B. H., Nickerson, J. A., & Owan, H. (2003). Team incentives and worker heterogeneity: An empirical analysis of the impact of teams on productivity and participation. *Journal of Political Economy*, (3) 465–498.
- Holmstrom, B. (1982). Moral hazard in teams. *Bell Journal of Economics*, 13(2), 324–340.
- Holmstrom, M. (1989). *Industrial democracy in Italy*. Aldershot: Avebury.
- Jensen, M., & Meckling, W. (1979). Rights and production functions: Application to labor-managed firms in co-determination. *Journal of Business*, 52, 409–506.
- Jones, D. (1987). The productivity effects of worker directors and financial participation by employees of the firm: The case of British retail cooperatives. *Industrial and Labor Relations Review*, 41, 79–92.
- Jones, D., & Svejnar, J. (1985). Participation, profit-sharing, worker ownership and efficiency in Italian producer cooperatives. *Economica*, 52, 449–465.
- Jones, D. C., & Mygind, N. (2002). Ownership and productive efficiency: Evidence from Estonian panel data. *Review of Development Economics*, 6(2), 284–301.
- Jones, D. C., & Pliskin, J. (1991a). The effect of worker participation, employee ownership, and profit sharing on economic performance: A partial review. In: V. Rus & R. Russell (Eds), *Participation, ownership and the nature of work*. Oxford University Press.
- Jones, D. C., & Pliskin, J. (1991b). *The productivity effects of profit-sharing and worker representation on the board*. Mimeo: Hamilton College.
- Jones, D. C., Kalmi, P., & Kauhanen, A. (2006). Human resource management policies and productivity: New evidence from an econometric case study. *Oxford Review of Economic Policy*, 22, 526–538.

- Kalmi, P., & Klinedinst, M. (Eds). (2006). Participation in the age of globalization and information. *Advances in the economic analysis of participatory and labor managed firms*. (Vol. 9), Elsevier.
- Keane, M., & Runkle, D. (1992). On the estimation of panel-data models with serial correlation when instruments are not strictly exogenous. *Journal of Business and Economic Statistics*, 10, 1–9.
- Kruse, D., Freeman, R., Blasi, J., Buchele, R., Scharf, A., Rogers, L., & Mackin, C. (2004). Motivating employee-owners in ESOP firms: Human resource policies and company performance. *Advances in the Economic Analysis of Participatory and Labor Managed Firms*, 8, 101–128.
- Lazear, E. (2000). Performance pay and productivity. *American Economic Review*, 90(5), 1346–1361.
- Lee, B. (1988). *Productivity and employee ownership: The case of Sweden*. Stockholm: Trade Union Institute for Economic Research.
- Macleod, B. (1984). *A theory of co-operative teams*. CORE Discussion paper 8441. Universite Catholique de Louvain.
- Newey, W., & West, K. (1987). A simple positive semi-definite heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica*, 55, 703–708.
- Pencavel, J. (2001). *Worker participation: Lessons from the worker-coops of the Pacific Northwest*. New York: Sage.
- Pencavel, J., & Craig, B. (1994). The empirical performance of orthodox models of the firm: Conventional firms and worker cooperatives. *Journal of Political Economy*, 102, 718–744.
- Pittatore, S., & Turati, G. (2000). A map of the property rights in Italy and the case of cooperatives: An empirical analysis of Hansmann's theory. *Economic Analysis*, 3(1), 23–48.
- Prendegast, C. (1999). The provision of incentives in firms. *Journal of Economic Literature*, 37(1), 7–63.
- Smith, S. C. (1994). Innovation, and market strategy in Italian industrial cooperatives: Econometric evidence on organizational comparative advantage. *Journal of Economic Behavior and Organization*, 23, 303–320.
- Uvalic, M. (1990). *The Pepper report*. Florence: European University Institute.
- Wadhvani, S., & Wall, M. (1990). The effects of profit-sharing on employment, wages, stock returns and productivity: Evidence from UK micro-data. *Economic Journal*, 100, 1–17.
- Weitzman, M., & Kruse, D. (1990). Profit sharing and productivity. In: A. Blinder (Ed.), *Paying for productivity: A look at the evidence* (pp. 95–141). Washington, DC: Brookings.
- Zevi, A. (1982). The performance of Italian producer cooperatives. In: D. C. Jones & J. Svejnar (Eds), *Participatory and self-managed firms*. Lexington, MA: Lexington Books.

## APPENDIX. DEFINITIONS OF VARIABLES

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<i>Q</i>	= value added = sales + final inventories – initial inventories – purchased inputs (For conventional firms, value added also adds in “any capitalization of fixed assets and cost adjustments, such as expenses recovered from customers or third parties and in general all income additional to that earned in the normal course of business.” For cooperatives, we calculated purchased inputs as the sum of production inputs and “commercial costs of sales and general expenses.” We also included the value of “work in economic and domestic production” as part of production by cooperatives. Increases in works-in-progress on contracts lasting more than 1 year are included in the sales of conventional firms, and therefore in their value added.)
<i>L</i>	= permanent employees at year end (For conventional firms, there was no explicit reference to permanent employees.)
<i>K</i>	= fixed assets at historical cost
BONUS	= average distributed profits per worker (Distributed profits consists of transfers to members (after settlement of profits), salary integration (after settlement of profits), member transfers (if considered among costs), and salary integration (if considered among costs)). BONUS is assumed to be zero for conventional firms.
MEMB	= proportion of permanent employees who are members of the cooperative
OWN	= average capital stake per worker-member
LEND	= average loan capital per worker member (Total loan capital includes loans from both worker members and other members.)
RES	= average collectively owned reserves per worker-member
LABOR COSTS	= salaries and stipends, contributions, and returns to retirees (For conventional firms, it consists of wages, salaries, social security contributions, and charges to severance indemnity provisions.)
PROFITS	= trade profit

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*Note:* All values are in millions of 1985 lire.

# ORGANIZATIONAL CAPITAL, PRODUCT MARKET COMPETITION AND TECHNICAL EFFICIENCY IN ITALIAN COOPERATIVES

Ornella Wanda Maietta and Vania Sena

## ABSTRACT

*This paper tries to identify under which conditions increasing market competition may help cooperatives to improve technical efficiency to guarantee positive profits. This hypothesis is first formalized in a partial equilibrium framework and then is tested on a sample of Italian conventional and cooperative firms, using frontier analysis. Technical efficiency indexes are computed by using the one-stage approach as suggested by Battese and Coelli (1995), where proxies for competition are introduced as determinants of efficiency, along with other exogenous factors accounting for the firms' heterogeneity. However, the overall impact of increasing competition on efficiency is negative.*

## 1. INTRODUCTION

It is a contentious issue in the economic literature whether cooperatives tend to be more (or at least as) efficient than conventional firms (Bonin, Jones, &

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Putterman, 1993; Porter & Scully, 1987). From a theoretical standpoint, there are a number of reasons why a cooperative should experience a higher level of efficiency than a conventional firm. A first group of theories emphasizes the positive impact that profit sharing can have on workers' effort. In a conventional firm, asymmetric information does not allow the management to verify the worker's effort and so workers may prefer to shirk and so exert less than optimal level of effort. The profit-sharing agreement existing in a cooperative may help to realign the workers' incentives to those of the firm in several ways. It may enhance workers' effort in return for what they could perceive as the company's fairness in letting them participate in the economic success of the firm (so-called gift exchange) (Sessions, 1992). Profit sharing may also provide employees in a cooperative with an incentive to monitor each other and put pressure on shirkers (Jones & Svejnar, 1985). Finally, it may give workers and managers the incentive to circulate information, which in turn may limit the asymmetric information problem and so increase the productivity (Cable & Wilson, 1989). A second group of theories looks at the role that profit sharing in a cooperative can have on the workforce attributes, for instance skill levels. It is well known that in conventional firms workers may not be willing to invest in firm-specific skills. The reasons for this are well articulated in Hart (1995). When the workers' investment is not contractible (i.e., contracts are incomplete) and, at the same time, workers have to bear all the costs of the investment, they may correctly anticipate that the firm will try to expropriate them after the investment has been made. Therefore, they find optimal to under-invest. Profit sharing can, however, help to solve this problem. Indeed, with profit-sharing workers are made residual claimants of the firm, as they are entitled to a portion of the profits. In this case, workers, aware of the fact that some of the improved performance will accrue to them, will be willing to invest in costly firm-specific skills as profit sharing reduces the potential for ex-post expropriation.

As the above-mentioned literature, the purpose of this paper also is to understand what factors may explain the fact that cooperatives tend to be more efficient than conventional firms. However, it differs from it as we focus on the possibility that the state of competition in the product market may affect the incentives for cooperatives to improve their efficiency. For conventional firms, the role that competition may play in this respect is subject to substantial debate. Both Vickers (1995) and Nickell (1996) have pointed out two ways in which competition may induce conventional firms starting from low level of efficiency and productivity to be more efficient. The first effect is called "discovery and selection." In a model of entry with

Cournot competition, a low-cost entrant may drive some high-cost incumbent out and the profitability of firms will be affected as output shifts from high-cost firms to low-cost firms. The second effect of competition is to sharpen incentives for managers, as they try to compensate the decreasing market share with higher productivity. In both cases, what we would observe is increasing average efficiency and productivity in the industry. However, this positive effect of increasing product market competition on efficiency may be counterbalanced by the fact that this may decrease the so-called firm's organizational capital (referring to all the practices and relationships that allow the firms to conduct its production process in an effective way) that still have an impact on technical efficiency (Jones, Klinedinst, & Rock, 1998). This implies that the overall effect of product market competition on efficiency is rather ambiguous.

The case of cooperatives is even more uncertain. It is not obvious that any of the two mechanisms outlined above can help cooperatives to be more efficient against increasing market pressure. Indeed, the first mechanism assumes that firms can exit immediately the product market and it is well known that this may not be necessarily the case for co-ops because of its well-known structural features (slow speed of the decision-making process, legal reasons and so on). The second mechanism may not work as well, as managers in a co-op respond differently, to different incentives, from those in a conventional firm and this implies that they may not necessarily try to reduce the slack in the organization.<sup>1</sup> Also as in a conventional firm, organizational capital may decrease when market pressure increases with an adverse impact on technical efficiency. It is possible though that other mechanism may work in a co-op that can be helpful to improve technical efficiency when market pressure increases. In this paper, we explore the link between workers' effort and profits sharing as a potential mechanism that gives workers the incentives to improve efficiency so as to guarantee the firm's survival. The reasons for this argument can be summarized as follows. Consider a cooperative where (a) workers have control rights over a specific "asset," their effort and (b) are paid by a fixed fraction of the overall surplus. The cooperative organizes the production using both a fixed asset and the worker's effort as inputs. To be able to produce, the cooperative needs the worker's effort i.e., without the workers' effort, production cannot start. Because of the lag between the time the firm starts the production and the time the workers decide on effort, a standard hold-up problem arises (Hart, 1995). Workers prefer to invest in the effort so as to maximize their own expected pay-off from the relationship with the firm, instead of the overall surplus (i.e., both the workers' and firms' surplus). Therefore, the



supplied effort is sub-optimal from the firm's standpoint and so it will appear inefficient, as the actual output will be lower than the potential output (or the output produced by the other firms in the industry). Suppose now there is an increase in the competition faced by the cooperative in the market. This may be due to several factors, some of which are related to economic policy (like the reduction of tariffs and other artificially created barriers to entry) and some to consumer's taste. From the workers' standpoint, this implies that their profit sharing-bonus decreases as well and therefore they may want to readjust their effort so as to counterbalance the effect of the negative shock on the profit-sharing bonus. However, this will not have any impact on the profit-sharing bonus at this stage (as the level of investment is determined in the period before the shock) but it will have an effect on the next period's bonus. These readjustments affect the firm's technical efficiency. As workers increase their investment, the actual output increases and gets closer to the potential output. The result is that through this mechanism, the co-op's inefficiency may reduce. However, it is difficult to predict the overall impact on technical efficiency as this positive effect may be counterbalanced by the reduction of organizational capital. Obviously in this case only empirical analysis can solve this ambiguity. Therefore, we test empirically these predictions for a panel of conventional and cooperative Italian firms, specialized in the production of wine, over the period 1996–2001, by estimating a one-stage stochastic production frontier where measures of technical efficiency are computed conditional on a set of factors (in our case, state of competition in the product market) that can explain the distribution of scores across firms (Battese & Coelli, 1995). Stochastic frontiers have been widely used in the comparative economics literature and the literature on workers' participation to compare the effects of different types of ownership on technical efficiency (Ferrantino, Ferrier, & Linvill, 1995): this methodology offers the advantage that it allows to compute the firms' technical efficiency while at the same time controlling for the factors that can affect the dispersion of efficiency across the firms. The choice of the Italian cooperative sector for this type of analysis is not casual: the Italian wine sector has been subject to substantial pressure from foreign competitors in the period under examination; also Italy has got a very large cooperative sector and indeed, not surprisingly, several studies have been conducted on Italian cooperatives with the purpose of testing several hypotheses of the literature on co-ops (see Jones & Svejnar, 1985 and Bartlett, Cable, Estrin, Jones, & Smith, 1992).

The structure of the paper is the following. Section 2 presents a model of the theoretical relationship between competition, technical efficiency change,

and profit sharing. The empirical model and the results are presented in Section 3. Finally some concluding remarks are offered in Section 4.

## 2. THE GENERAL FRAMEWORK

Consider an industry with  $i = 1, \dots, N$  firms. Some of these firms are co-operatives and some are conventional firms. There are  $i = 1, \dots, N$  identical workers and worker  $i$  works in firm  $i$ . The allocation of each worker to each firm is predetermined and the worker cannot leave the firm. Each firm produces a differentiated good and faces a downward-sloping demand curve. Each period both types of firms use the following production technology, where the worker's effort appears as an input:

$$y_{i,t} = A_i^{-\gamma\theta} e_{i,t}^\alpha \quad (1)$$

with  $\alpha < 1$  and  $0 < A_i \leq 1$ . Also, the level of output is affected by the level of organizational capital (as captured by  $A_i$ ) that we assume to be affected negatively by the degree of competition in the market ( $\theta$ ). The worker in the firm provides a firm-specific input ( $e$ ) that we can think of as related to the effort of learning new techniques that are specific to the firm and that therefore outside the firm are of no use. We assume that in every time period new techniques are to be learnt by the worker. However, the decision on how much effort to invest in period  $t$  is made in period  $t-1$  where the planning is done.<sup>2</sup>

Output is being sold at the price:

$$p_{i,t} = y_{i,t}^{\theta-1} \bar{y}_{i,t}^{1-\theta} = y_{i,t}^{\theta-1} \quad (2)$$

where  $y_{i,t}$  is the supply of the good  $i$ ,  $\bar{y}$  is an index of the overall market demand, assumed for simplicity to be equal to 1 and  $0 < \theta < 1$ . We interpret  $\theta$  as an indicator of product market competition, where a large value is an indication that product market competition is intense.

In both the conventional and the co-op, the worker decides each period on how much effort to devote for the next period. Once the decision has been made, it cannot be undone immediately. We assume that (unlike workers in a conventional firm) the co-op's worker in firm  $i$  is rewarded by a share  $s_i$  of the profit  $p_{i,t}y_i$ . The per period utility function of the worker is defined as

$$U_{i,t} = c_{i,t} - \frac{1}{2}e_{i,t}^2 \quad (3)$$

with  $c_{i,t}$  being the consumption of the worker employed in the firm  $i$  at time  $t$ . His budget constraint is  $c_{i,t} = s_i p_{i,t} y_{i,t}$ . Lifetime utility is then

$$U_i = \sum_{t=0}^T \delta^t (s_i p_{i,t} y_{i,t} - \frac{1}{2} e_{i,t}^2) \quad (4)$$

where  $\delta$  is the discount factor and  $e_{-1} = 0$ .

To simplify the analysis, we shall consider a three-period version of the model with period  $t = 0, 1, 2$ . The time line of the model is as follows. At time 0, the co-op is set up and the worker of the firm is hired. At time 1, the worker decides on  $e$ . At time 2, the fixed asset is hired and so production can take place. Output is then sold and the surplus shared between the worker and the members. The worker consumes at the end of the period. Because of the lag between the moment the co-op organizes the production and the time the worker decides on effort, it is impossible to write complete contracts and therefore a standard hold-up problem (Hart, 1995) arises: indeed the worker maximizes his own expected pay-off from the relationship with the firm, instead of the overall surplus (i.e., both the worker's and firm's surplus). Therefore, the effort is optimal from the worker's standpoint, but not for the co-op. For this reason, the co-op's actual output will differ from the output it could potentially produce if there was no hold-up problem and so it will appear technically inefficient. Notice that in the whole process the two parties have symmetric information and there is no uncertainty about the parties' costs and utility functions. We analyze the model by backwards induction and assume perfect foresight. Finally, we derive the measure of technical efficiency and measure how it varies when there is an increase in product market competition. In period 2, the worker is not going to invest any effort as there is no future and production takes place:

$$y_{i,2} = A_{i,1}^{-\gamma\theta} e_{i,1}^\alpha \quad (5)$$

and the worker's profit-sharing bonus (that is consumed by the worker) is  $s_i p_{i,2} y_{i,2}$ . In period 1, the worker's effort choice is

$$e_{i,1}^* = \arg \max \delta s_i p_{i,2} y_{i,2} - \frac{1}{2} e_{i,1}^2 \quad (6)$$

$$= (\delta s_i \theta \alpha)^{\frac{1}{2-\alpha\theta}} A_{i,1}^{\frac{-\gamma\theta(\theta-1)}{(2-\alpha\theta)}} \quad (7)$$

A sufficient condition for (7) to be a maximum is  $\theta < 2\alpha^{-1}$ . In period 0, the worker faces a similar problem and he chooses similarly. Effort is not

always increasing in the degree of competition ( $\theta$ ). To see this consider (7) and take the logs:

$$e_{i,1}^* = \frac{1}{2 - \alpha\theta} \log(\delta s_i \theta \alpha) + \frac{-\gamma\theta(\theta - 1)}{2 - \alpha\theta} \log A_{i,1}$$

Then:

$$\frac{\partial e_{i,1}^*}{\partial \theta} = \frac{\theta}{2 - \alpha\theta} + \log(\delta s_i \theta \alpha) \frac{\alpha}{2 - \alpha\theta} + \log A_{i,1} \frac{2 + \alpha\theta^2 - 4\theta}{(2 - \alpha\theta)^2} \quad (8)$$

For this derivative to be positive, it is required that  $\theta < 2\alpha^{-1}$  and that  $-3\theta + \alpha + 2\alpha\theta^2 > -2$ . Both conditions are met for values of  $\alpha$  closer to 1. The reason why the impact of product market competition on effort is ambiguous is rather straightforward. The worker makes his effort decision based on expectations about future revenues. If he anticipates that competition gets stiffer and therefore expected profit-sharing bonus will decrease, he decides to spend more effort so as to increase the co-op's output and this way its profit-sharing bonus. The worker also anticipates that competition affects negatively the firm's organizational capital and may not be willing to increase effort and so the overall impact of increasing competition on effort may be negative. However, if the impact of effort on the level of production is quite large, then the worker is willing to increase the effort so as to offset the negative impact of the loss of organizational capital on the production.

The industry is populated with firms with different input characteristics and therefore technical efficiency would be higher in some firms rather than in others. We can measure technical efficiency in firm  $i$  in period  $t$  as the ratio between the actual level of output produced at time  $t$  by the firm  $i$  ( $y_{i,t}$ ), and the potential output, which could be produced at time  $t$  ( $\hat{y}_{i,t}$ ) (Farrell, 1957). This is usually determined by the available technology and it is independent of the state of competition in the product market (Haskel & Sanchis, 2000).

$$TE_{i,t} = \frac{y_{i,t}}{\hat{y}_{i,t}} \quad (9)$$

Our main interest is to find out how technical efficiency in periods 1 and 2 in firm  $i$  is affected by a permanent, but unexpected change in the product market competition in period 1. The fact that it is unexpected implies that it could not be taken into account when effort was decided in period 0. The fact that it is permanent implies that worker will wish to adjust the effort

choice made in period 1, once he has observed the change in period 1. Many different factors, some related to specific policies and some to consumers' taste affect the intensity of competition in the product market. Among the policy related factors we find tariffs and other artificially created barriers to entry that reduce competition, as well as policies that advance competition by introducing product standardization. Among the taste related factors, we notice that firms can avoid competition by exploiting the fact that consumers typically have a preference for variety and for particular brands. It is also important to note that the change to product market competition is specific to firm  $i$ , that is, the shock is firm specific.

Consider first what happens to technical efficiency in period 1 in a co-op. Since the effort has already been decided in period 0 based on expected competition, we get

$$\frac{\partial TE_{i,1}}{\partial \theta} = 0 \quad (10)$$

Next, consider period 2. After the change has been observed in period 1, it is incorporated in the expectations and the worker adjusts her effort choice to accommodate the new environment in period 2. The change in technical efficiency in period 2 is therefore given by

$$\frac{\partial TE_{i,2}}{\partial \theta} = \frac{\alpha(\partial e_{i,1}^*/\partial \theta)^{\alpha-1}}{\hat{e}_{i,1}^{\alpha}} \quad (11)$$

When product market competition increases, technical efficiency may and may not increase as well. The intuition behind this result is quite simple. An increase in competition implies for the worker that their profit-sharing bonus decreases and therefore they may want to readjust their effort so as to counterbalance the negative effect of competition. However, the decrease in organizational capital may imply that the increase in effort may not be sufficient to generate an increase in technical efficiency. These readjustments have an impact on the firm's technical efficiency. If workers increase their effort in the first period and this increase is sufficiently large, then the actual output in period 2 increases and gets closer to the potential output. The result is that inefficiency in period 2 for the co-op reduces. Let us contrast the co-op's case with that of the conventional firm. The increase in competition will simply worsen the firm's technical efficiency because there is no mechanism that induces workers to increase effort. So in the case of conventional firms technical efficiency is bound to decrease within this type of analytical framework.

### 3. THE EMPIRICAL ANALYSIS

#### *3.1. The Institutional Framework*

The Italian cooperative system is one of the largest in the Western economies and not surprisingly it has been the object of substantial interest by economists (Bartlett et al., 1992; Jones & Svejnar, 1985). The Italian cooperative movement goes back to the insurance societies of the 19th century with a first confederation of cooperatives (Lega Nazionale delle Cooperative) established in 1886. Today, the cooperative sector contributes to the 7–8% of GDP (Lega delle Cooperative, 2006) and around 38,000 workers cooperatives can be found in Italy (Pencavel et al., 2005). They are in virtually all regions, although more than 40% are located in Emilia Romagna, Campania, and Sicilia.

Italian co-ops operate on the principles of the International Cooperative Alliance: one member–one vote, free and voluntary membership, and limited remuneration of the underwritten capital. Membership in a co-op requires an individual to provide a portion of its capital with the agreement that on leaving (s)he will be repaid the value of the contributed capital. Co-ops can hire workers who are not required to be members; however, it is common practice for workers to become members of the co-op (Pencavel et al., 2006). Co-ops are required to allocate at least 20% of its revenues to its legal reserve fund that is collectively owned and cannot be recouped by individual workers upon leaving the firm. The remaining profits can be used for remunerating capital underwritten by members, to increase the reserve fund, to finance social and service activities, and to distribute among the workers/members in proportion to their work. Decisions about the distribution of net revenues are made by each co-op's General Assembly. Each member has only one vote and only co-ops workers are members. Most co-ops distribute profits to members and nonmembers on the same terms, but there may be bonuses that members enjoy. By vote, the General Assembly selects a Council, the principal supervisory body that appoints the managers and specifies the general policies. Typically, though, there is extensive participation by co-op members in decision making and considerable turnover of officers.

#### *3.2. The Empirical Specification*

The key prediction from the model is that cooperatives' technical efficiency may increase as competition increases. To test this theoretical prediction, we

use the so-called frontier approach to the measurement of technical efficiency where technical efficiency scores are computed as the distance from an estimated parametric production frontier. More specifically, we use the model by Battese and Coelli (1995) where the inefficiency effects ( $u_{it}$ ) are expressed as an explicit function of a vector of firm-specific variables and a random error. The advantage of this approach is that both the technology and the inefficiency parameters are obtained by using a single-stage estimation procedure and this allows to simultaneously compute the efficiency scores while controlling for the factors that influence the distribution of scores across different observations. The model specification is the following:

$$\begin{aligned} \ln(y_{it}) = & \beta_0 + \beta_1 \ln(K_{it}) + \beta_2 \ln(L_{it}) + \beta_3 \ln(K_{it})^2 \\ & + \beta_4 \ln(L_{it})^2 + \beta_5 \ln(K_{it}) \ln(L_{it}) \\ & + \rho_1 \ln(K_{it}) \text{ COOP} + \rho_3 \ln(L_{it}) \text{ COOP} + \rho_4 \text{ COOP} + \rho_5 \text{ YEAR} \\ & + \rho_6 \text{ SOUTH} + (v_{it} - u_{it}), \quad i = 1, \dots, N, t = 1, \dots, T \end{aligned} \quad (12)$$

where  $\ln(y_{it})$  is the logarithm of the production of the  $i$ th firm at the  $t$ th time period,  $\ln(K_{it})$ ,  $\ln(L_{it})$  are the logs of capital and labor, respectively, of the  $i$ th firm at the  $t$ th time period and  $\beta$  and  $\rho$  are a vector of unknown parameters. We allow for the possibility of disembodied technical progress by introducing a time trend (YEAR) in the model. Also in the specification of the technology we introduce the dummy variable SOUTH that controls for the firms located in the South of the country. Indeed these firms may use an inferior technology (as their location prevents them to acquire the most advanced technology) that does not let them to be as productive as the firms in the North. We control for the cooperative status by multiplying the inputs' levels by a COOP dummy. The intuition is that cooperatives use a different capital/labor ratio than conventional firms (due to financial constraints they face and so on) and this specification allows controlling for this in the most effective way. We also introduce among the regressors the dummy COOP on its own so to control for eventual features of the cooperative status that can affect the technology but not necessarily through the inputs' levels. The  $v_{it}$  are random variables which are assumed to be iid as a  $N(0, \sigma_v^2)$ , and independent of the  $u_{it}$ ; in turn these are nonnegative random variables assumed to account for technical inefficiency in production and to be independently distributed as truncations at zero of the  $N(\mu_{it}, \sigma_u^2)$  distribution with  $\mu_{it} = z_{it}\delta$ , where  $z_{it}$  is a  $p \times 1$  vector of variables which may influence the efficiency of a firm and  $\delta$  is a  $1 \times p$  vector of parameters to be

estimated together with  $\sigma^2 = \sigma_v^2 + \sigma_u^2$  and  $\gamma = \sigma_u^2 / (\sigma_v^2 + \sigma_u^2)$ . Our efficiency effects model is the following:

$$u_{it} = \delta_0 + \delta_1 \text{SOUTH} + \delta_2 \text{COOP} + \delta_3 \text{YEAR} + \delta_4 \text{COMP}_{i,t-1} \\ + \delta_5 \text{COMP}_{i,t-1} \times \text{COOP}$$

where SOUTH is the dummy variable for firms located in the South of Italy, COOP is the dummy for the co-ops, YEAR is the time trend, and COMP is the measure of the firm's market power. Recall that in this type of model a positive (negative) coefficient means that the variable in question has a negative (positive) impact on efficiency (indeed the dependent variable is the relative inefficiency). Market power is measured by the individual firm's market share; this has been lagged so as to avoid potential endogeneity problems in the regression model.<sup>3</sup> We control also for the firm's location with the variable SOUTH in the specification of the inefficiency model. It is a well-established piece of evidence in the Italian literature that location matters for productive efficiency. A typical example is provided by Southern firms that tend to show low levels of efficiency. This is to be probably ascribed to the operation of local factors such as infrastructure endowment, external economies linked to the local technological potential or level of industrialisation, the presence of organised crime, and so on. We introduce the time trend YEAR in the specification of the inefficiency model so as to control for the impact on technical efficiency of factors like weather, pests, and so on (INEA, 2001).

### 3.3. The Data Set

The data set we use is an unbalanced panel of Italian conventional and cooperative firms from 1996 to 2001, belonging to the sector of Wine Production<sup>4</sup> (corresponding to the code A01131 of the Ateco 91 classification supplied by ISTAT, Italian Statistical Office). The data set we use has been extracted from AIDA,<sup>5</sup> a database collecting the annual balance sheets of those Italian companies whose operating revenue is equal to a minimum of 1 million euros. In addition to the information contained in the annual reports, the database reports information on companies' location, the legal status and additional financial data, like short-term and long-term debts. The total number of observations over the five years is 413. According to their legal status, 63 firms (corresponding to 250 observations over the whole time period) are cooperatives, while 40 firms (corresponding to 163 observations) are conventional.



The wine industry has been selected for a number of reasons: first, the firms' output mix is limited compared to that of firms belonging to other sectors as they produce only wine;<sup>6</sup> therefore the firms in our sample will be more homogenous in terms of technology. Homogeneity of the technology available to the firms in the data set under consideration is an important requirement of the frontier analysis to be able to get meaningful frontier estimates. In addition, the number of cooperatives in the Italian wine industry has always been substantial and this implies that their market share has always been quite comparable to that of the conventional firms (van Bekkum & van Dijk, 1998). Finally, firms operating in the wine sector require workers to have some firm-specific skills, consistently with what is described in the theoretical model. Indeed, the land and weather conditions are different from firm to firm and this implies that the workers are required to learn skills (Pagano, 1992; Huffman, 2001) that cannot be easily transferred to other firms even if operating in the same sector (Galizzi, 2000).

In our production set, output is measured by the company's added value (ISTAT, 2002). Among the inputs, we include the capital and the labor. Capital is the sum (at book value) of land, buildings, machinery, and other fixed assets. This has been deflated by the price index of investment goods for the beverage industry (ISTAT, 2002). All these variables (both of output and inputs) are expressed in 1995 million Italian liras. Labor is the number of employees at the end of the fiscal year and includes both full-time and seasonal workers. The market share has been computed as the firm's total output over the industry total output (Klinedinst et al., 1998).

Table 1 reports the sample statistics for the output, inputs and for conventional and cooperative firms, respectively. On average, cooperatives produce more than conventional firms, and comparatively use less capital and labor for each year under consideration. This relative undercapitalization of co-ops is quite common and not limited to the Italian co-ops. It is usually explained by the fact that members of co-ops do not have an incentive to invest in capital equipment as they may not appropriate the increase in value following the investment, in case they decide to leave the cooperative (Mosheim, 2002). The stiffening of the competitive environment is reflected in the steady decline of the market share over the period for both types of firms. This is the result of two simultaneous factors: first, the market share of Italian wines in foreign markets has decreased due to aggressive marketing of foreign wine producers in the international markets. Second, during this same period, the European Union (EU) has started to reduce the size of subsidies to firms operating in the agricultural sector and this has implied a downsizing of most companies whose size was not financially

**Table 1.** Descriptive Statistics.

Statistic	Output	Capital	Labour	Market share
Cooperatives				
1997	8,852	3,188	27	1.46
1998	7,181	2,918	22	1.02
1999	7,456	2,990	21	1.05
2000	8,979	3,715	25	1.03
2001	7,359	3,653	23	0.84
Conventional firms				
1997	6,514	12,749	29	1.01
1998	6,971	11,253	27	0.88
1999	6,818	11,102	34	0.92
2000	8,173	11,752	38	0.83
2001	7,395	8,955	28	0.76

viable (van Bekkum & van Dijk, 1998). Interestingly, though, in spite of the general decrease of market share across the two groups of firms, the co-ops still are able to keep a larger market share than traditional firms.

#### 4. THE RESULTS

The maximum likelihood estimates of (12) are reported in Table 2. The LR test on  $\gamma$  ( $H_0 : \gamma = 0$ ) is equal to 200.3 with number of restrictions equal to 7 (against a critical value of 7.05 at a 5% significance level);<sup>7</sup> this shows that the frontier model is significant improvement over the traditional OLS estimation of the production function. The translog specification has also been tested against the Cobb–Douglas specification and is accepted on the basis of a LR test that is equal to 21.18 with number of restrictions equal to 4 (against a critical value of 9.49 at a 5% significance level). The significance of the coefficients related to inputs is fairly good. There is no empirical evidence of disembodied technical progress.<sup>8</sup> Also, the variable SOUTH is not significant implying that there is no evidence that firms (both co-ops and conventional) located in the South have access to less advanced technology. However, there is evidence that the cooperative status has an impact on the level of production independently of the input levels. The data have been mean-corrected so that the first-order coefficients can be interpreted as the average input elasticities for the industry. On average for the wine industry, the value of input elasticities are equal to 0.071 for capital and 0.18 for labor

**Table 2.** MLE Estimates.

Variable	Coefficient	t-Ratio
Constant	0.8144	6.7952
Ln $K$	0.0359	1.7326
Ln $L$	0.0674	1.9641
Ln $K^2$	0.0010	0.2785
Ln $L^2$	0.0208	1.6578
Ln $K^*Ln L$	-0.0002	-0.0179
Ln $K^*COOP$	0.0719	3.4975
Ln $L^*COOP$	0.1853	5.2692
COOP	-0.7154	-6.6044
YEAR	0.0005	0.0560
SOUTH	-0.0557	-1.7577
$\mu_0$	0.9932	6.5001
COOP	-1.5075	-6.8765
COMP*COOP	11.3433	2.1862
COMP	-34.9715	-3.5171
SOUTH	0.1766	2.2006
YEAR	-0.0378	-1.3197
$\sigma^2$	0.1810	5.4950
$\gamma$	0.9439	69.5810

**Table 3.** Technical Efficiency Estimates.

Year	Cooperatives	Conventional Firms
1997	0.831	0.510
1998	0.848	0.522
1999	0.867	0.526
2000	0.878	0.527
2001	0.867	0.512

in the case of cooperatives and 0.03 for capital and 0.068 for labor in the case of conventional firms.

Among the factors used to explain inefficiency, the dummy for the South of Italy is significant: firms located there tend to be more inefficient; besides, co-ops are more efficient than conventional firms, as can be seen from Table 3. The coefficient of the variable YEAR is not statistically significant. The competition variable is statistically significant and positive: generally competition does increase inefficiency but the interaction with the dummy for co-ops is significant and negative; this means that inefficiency for co-ops decreases as they face increasing competition. However the net impact of

increasing competition on inefficiency is positive implying that the loss of organizational capital offsets the increase in effort due to profit-sharing effect. Moreover, the fact that increasing competition has a negative impact on the levels of efficiency of conventional firms is consistent with our theoretical model. Indeed, it is reasonable to assume though that eventually conventional firms will be able to increase efficiency once they have absorbed the shock of increasing competition, and as other mechanisms enter into action. Interestingly this last result goes into the same line as the ones by Jones et al. (1998): by analyzing the relationship between firms' technical efficiency and increasing market competition in Bulgaria at the onset of the transition, they find that firms with a large market share have a better performance. This result is not surprising as the start of the transition was characterized by a loss of organizational capital that hit equally most firms.

We can finally observe from [Table 3](#) that co-ops are more efficient than conventional firms and that technical efficiency has increased for the co-ops unlike conventional firms. These results are not in contrast with the findings from previous studies on Italian cooperatives. [Jones and Svejnar \(1985\)](#) find that the superior performance of Italian producers' cooperatives could be ascribed to structural characteristics of co-ops like profit sharing and participation. Also, [Bartlett et al. \(1992\)](#) find that Italian co-ops achieve higher levels of both labour and capital productivity than comparable firms.

## 5. CONCLUDING REMARKS

In this paper, we have tested the extent to which increasing product market competition can help cooperatives to improve efficiency. As cooperatives are typically characterized by problems of hold-up and therefore appear to be inefficient, an increase in competition has the effect of realigning the workers' interests with those of the firm and therefore they will increase their investment in effort. However, at the same time, increasing product competition usually has a negative impact on the firm's organizational capital. These readjustments have an impact on the firm's technical efficiency. As workers increase their effort, the actual output increases and gets closer to the potential output and inefficiency for a co-op reduces; however, this effect can be offset by the loss of organizational capital and so the overall impact on efficiency may be uncertain and needs to be assessed empirically. To this purpose, we have used a panel of traditional and cooperative firms from Italy specialized in the production of wine over the period 1996–2001. The empirical results show that cooperative firms experience positive technical

efficiency change following an increase in competition but however because of the loss of organizational capital the net impact of increasing competition on technical efficiency is negative. In addition, this relationship does not hold for conventional firms where, on the contrary, technical efficiency may worsen. These results give support to the original hypothesis that increasing competition can help a cooperative to improve technical efficiency as it realigns the workers' interests with those of the firm but at the same time other factors may counterbalance this effect.

## NOTES

1. Indeed, they may be asked by the membership to promote employment-enhancing projects that may not necessarily be technically efficient.

2. In specification of this model, we do not allow for the team production. In other words, we do not try to model the interaction among different workers and the impact on technical efficiency of team production settings. Also, this is a partial equilibrium model so we do not consider variation of total employment in the firm.

3. See also Hay and Liu (1997) for a discussion on this point.

4. The firms classified in this sector include firms that both grow and process grapes to produce wine. For the remainder of the paper, we will refer to this sector interchangeably as the wine sector or wine industry.

5. More information on this database can be found at <http://www.bvdep.com/browse5.asp>.

6. In particular, the firms (both co-ops and conventional) included in our sample are specialized in the production of medium quality wine.

7. The critical values for the test that  $\gamma = 0$  are obtained from Table 1 of Kodde and Palm (1986) where the degrees of freedom are  $q + 1$  where  $q$  is the number of parameters assumed equal to zero, but are not boundary values.

8. There is no evidence of embodied technical progress since the LR test of the translog specification with embodied technical progress against the actual specification is equal to 2.4 with number of restrictions equal to 4 (against a critical value of 9.5 at a 5% significance level). The specification, with 4 dummy variables for each year, used to detect the presence of discontinuous technical progress, has also been rejected on the basis of the LR test equal to 0.16.

## REFERENCES

- Bartlett, W., Cable, J., Estrin, S., Jones, D., & Smith, S. (1992). Labor-managed cooperatives and private firms in North Central Italy: An empirical comparison. *Industrial and Labor Relations Review*, 46(1), 103–118.
- Battese, G. E., & Coelli, T. J. (1995). A model for technical efficiency effects in a stochastic frontier production function for panel data. *Empirical Economics*, 20, 325–332.

- Bonin, J., Jones, D. C., & Putterman, L. (1993). Theoretical and empirical studies of producer cooperatives: Will ever the twain meet? *Journal of Economic Literature*, 31(3), 1290–1320.
- Cable, J., & Wilson, N. (1989). Profit-sharing and productivity: An analysis of UK engineering firms. *Economic Journal*, 99, 366–375.
- Farrell, M. J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society Series A*, 120(3), 253–290.
- Ferrantino, M., Ferrier, G. D., & Linvill, C. B. (1995). Organizational form and efficiency: Evidence from Indian sugar manufacturing. *Journal of Comparative Economics*, 21(1), 29–53.
- Galizzi, G. (2000). Le caratteristiche strutturali dell'offerta dei prodotti agricoli. Mimeo, Piacenza.
- Hart, O. (1995). *Firms, contracts and financial structure*. Oxford: Clarendon Press.
- Haskel, J., & Sanchis, A. (2000). A bargaining model of Farrell Inefficiency. *International Journal of Industrial Organisation*, 18(4), 539–556.
- Hay, D. A., & Liu, G. S. (1997). The efficiency of firms: What difference does competition make? *The Economic Journal*, 107(May), 597–617.
- Huffman, W. E. (2001). Human capital: Education and agriculture. In: B. L. Gardner & G. C. Rauser (Eds), *Handbook of Agricultural Economics*. Amsterdam: Elsevier Science.
- INEA (2001). *Annuario dell'agricoltura italiana*. Napoli: Edizioni Scientifiche Italiane.
- ISTAT (2002). Numeri indici dei prezzi alla produzione e al consumo. Collana Informazioni, N° 54, Roma.
- Jones, D., & Svejnar, J. (1985). Participation, profit sharing, worker ownership and efficiency in Italian producer cooperatives. *Economica*, 52(208), 449–465.
- Jones, D., Klinedinst, M., & Rock, C. (1998). Productive efficiency during transition: Evidence from Bulgarian panel data. *Journal of Comparative Economics*, 26, 446–464.
- Kodde, D. A., & Palm, F. C. (1986). Wald criteria for jointly testing equality and inequality restrictions. *Econometrica*, 54(5), 1243–1248.
- Lega delle Cooperative. (2006). *Internationalisation of cooperatives: Some experiences and reflections by Legacoop*. Mimeo, Rome, Italy.
- Mosheim, R. (2002). Organizational type and efficiency in the Costa Rican coffee processing sector. *Journal of Comparative Economics*, 30, 296–316.
- Nickell, S. J. (1996). Competition and corporate performance. *Journal of Political Economy*, 104(4), 724–745.
- Pagano, U. (1992). Organizational equilibria and production efficiency. *Metroeconomica*, 43(1–2), 227–246.
- Pencavel, J., Pistaferri, L., & Schivardi, F., (2005). *Wages, employment and capital in capitalist and worker-owned firms*. Mimeo, University of Stanford.
- Porter, P., & Scully, G. W. (1987). Economic efficiency in cooperatives. *Journal of Law and Economics*, 30(October), 489–512.
- Sessions, J. (1992). *Profit-sharing and gift exchange efficiency wage*. Loughborough University Discussion Paper, 11.
- van Bakkum, O. F., & van Dijk, G. (1998). *Lo sviluppo delle cooperative agricole nell'Unione Europea*. Ancona: Edizioni CLUA.
- Vickers, J. S. (1995). Concepts of competition. *Oxford Economic Papers*, 47(1), 1–23.

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# EFFICIENCY, ECONOMIC PERFORMANCE AND FINANCIAL LEVERAGE OF AGRIBUSINESS MARKETING CO-OPERATIVES IN CANADA

Getu Hailu, Scott R. Jeffrey and Ellen W. Goddard

## 1. INTRODUCTION

The agribusiness co-operative sector in Canada has been affected by on-going changes in economic, political, and social policies. Increased competition from local investor-owned firms and multinational companies, deregulation and globalization of trade and increased concentration of suppliers and purchasers have put tremendous competitive pressure on agribusiness marketing co-operatives. The enhanced level of competitive rivalry may force co-operatives into lowering costs and prices. Improvement in cost or operating efficiency of agribusiness marketing co-operatives may be crucial as changes in regulation, technology, and other market developments bring into question the long-term viability of co-operative businesses. Therefore, information as to the efficiency with which agribusiness co-operative firms operate would be useful.

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Empirical firm efficiency studies can play an important role in providing useful information for a variety of groups. Insights into the relative efficiency<sup>1</sup> of firms and the extent of inefficiency of individual firms is of value to managers, co-operative members, regulators, and directors. However, to date only a few studies have attempted to empirically measure the efficiency of agribusiness co-operative firms (Chen, 1997; Caputo & Lynch, 1993; Ariyaratne, Featherstone, Langemeier, & Barton, 2000; Singh, Coelli, & Fleming, 2001) and none have been undertaken in Canada.

Furthermore, although the notion of cost efficiency is one of the most commonly used tools in evaluating performance of firms within the agricultural and food markets, the literature investigating the association between cost efficiency and financial leverage, and firm size is limited. One of the major current issues concerning co-operative finance is the influence of debt leverage on co-operative performance. Theoretically, leverage can increase the pressure on managers to perform, through reduced incentives for moral hazard behaviour by reducing “free cash flow” at the disposal of managers (Jensen, 1986). This suggests a positive relationship between leverage and efficiency. Conversely, higher leverage may raise agency costs of debt because of conflicting interests between co-operative shareholders/members and debtholders, resulting in a negative relationship between leverage and efficiency (Jensen & Meckling, 1976; Myers, 1977). A study of the relationship between financial leverage and performance may provide insights into the impact of differences in access to debt or equity capital on the competitiveness of co-operative firms.

The major objective of this study is to rigorously analyze cost efficiency for a sample of 96 agribusiness marketing co-operatives in Canada, using panel data over the period 1984–2001. The specific objectives are to: (i) measure cost efficiency of agribusiness marketing co-operatives in Canada using random parameters stochastic frontier models; and (ii) investigate the impact of financial leverage and firm size on their cost efficiency.

## **2. AGRICULTURAL MARKETING CO-OPERATIVE SECTOR**

Agribusiness co-operatives have played a major role in the marketing of agricultural products in Canada. Agribusiness marketing co-operatives benefit members through provision of services such as handling, processing, selling, grading, transporting, and bargaining. These contributions have a significant impact on the economy; in 2001, the value of all Canadian

**Table 1.** Estimates of Trends in Market Shares (per cent) of Selected Agricultural Marketing and Supply Co-operatives in Canada (1985–2001).

	1985	1990	1991	1995	1996	1997	1998	1999	2000	2001
Dairy	58	46	59	57	59	62	64	66	59	42
Poultry and Eggs	37	40	39	51	57	51	51	53	49	49
Grains and oilseeds (West)	74	75	74	55	54	54	51	49	47	45
Honey and Maple	23	29	21	24	16	22	20	21	27	28
Livestock	30	32	14	18	20	18	20	19	11	14
Fruit and vegetables	33	26	13	23	32	21	23	15	6	8
Fertilizer and chemicals	–	–	36	–	–	–	–	–	40	41
Farm Petroleum	–	–	29	–	–	–	–	–	31	32
Feed	–	–	25	–	–	–	–	–	15	15
Seeds	–	–	17	–	–	–	–	–	11	8

*Source:* Co-operatives Secretariat, Government of Canada, 1985–2003. Co-operatives in Canada.

marketing co-operatives, including grain and oilseed, dairy and fruit and vegetable, amounted to \$14.24 billion. In 2001, there were more than 155 agricultural marketing co-operatives in Canada with approximately 202,000 members, more than \$5.3 billion in assets, and approximately 31,090 employees (Co-operatives Secretariat, 2003).

In recent years, the co-operative sector has experienced a drop in market share (Table 1).

During this same period many co-operatives have struggled with generating adequate capital. Inadequacy of capital has been a contributing factor for some grain co-operatives entering into strategic alliances with investor-owned firms (e.g., United Grain Growers with Archer Daniel Midland Company). In other cases, co-operatives have been sold outright (e.g., the sales of Agricore to United Grain Growers, and Dairyworld to Saputo Inc., both in 2001).

This pattern may suggest that when faced with tight operating margins and capital constraints, the traditional co-operative structure is not a low-cost ownership alternative. Capital constraints limit traditional agricultural co-operatives in their strategic investments, thus making them vulnerable to competition. Given the economic, social, political, and cultural importance of agricultural co-operatives to rural communities in Canada, this vulnerability may affect the well being of those who participate in co-operatives. Given a behavioral assumption of maximizing the sum of members' welfare (Enke, 1945), increasing market concentration/power in the agribusiness

sector (Cranfield et al., 1995; Fulton & Tang, 1999; Qian, 2004; Lopez, 1984) may contribute to significant welfare loss for co-operative members and consumers if co-operatives exit from markets or are restructured. Knowledge regarding the current level of efficiency and opportunities to improve the degree of efficiency will be useful for co-operatives in helping them to maintain their viability into the future.

### *2.1. Literature Review*

The study of economic efficiency (the development of efficiency) measurement dates back more than five decades (Debreu, 1951; Koopmans, 1951; Shephard, 1953; Farrell, 1957; Solow, 1957). Empirical firm efficiency analyses have been used extensively in various industries (e.g., transportation, banking, agriculture, electricity, health, sports, insurance, credit unions) to examine a variety of issues (e.g., impact of regulations, agency problems, firm risks, firm size, organizational structure). However, relatively few of these efficiency analyses have explored the efficiency of agribusiness co-operatives. Specifically, the efficiency literature concerning Canadian agribusiness co-operatives is very limited.

Some of these previous studies of agribusiness co-operative efficiency have addressed the question: "Are co-operatives more or less efficient than corresponding investor-owned firms?" The results have been mixed, with some studies (e.g., Ferrier & Porter, 1991; Berry, 1994; Stutzman & Stansell, 1992) concluding that co-operative firms are less efficient than investor-owned firms, while others (e.g., Zou, 1992; Singh et al., 2001) conclude that the opposite is true. Still other studies (e.g., Akridge & Hertel, 1992; Sexton & Iskow, 1993) conclude that efficiency differences between co-operative and investor-owned firms are insignificant; still some other studies (e.g., Craig, Pencavel, Farber, & Krueger, 1995) produced mixed results based on alternative measures.

Also examined in these studies are factors contributing to inefficiency or differences in efficiency across firms. Factors considered in these analyses include the level of technical efficiency (e.g., Caputo & Lynch, 1993), firm size (e.g., Ariyaratne et al., 2000; Esho, 2001; Lang & Welzel, 1999), financial leverage (Ariyaratne et al., 2000; Ariyaratne, Featherstone, Langemeier, & Barton, 1997a, b), and government policy (Esho, 2001). The results from these studies are also mixed, in terms of the nature and significance of the impact for these factors. The current study focuses on the impact of the degree of financial leverage and firm size on the efficiency of Canadian agribusiness marketing co-operatives.

## 2.2. Efficiency Measurement

Within production economics, economic efficiency is defined as a firm's ability to convert inputs into outputs and respond optimally to economic signals (i.e., prices). Economic efficiency may be decomposed into two parts; technical efficiency and allocative efficiency. Technical efficiency refers to the ability of a firm to achieve the maximum output obtainable from a specified set of inputs, given the existing technology. According to Färe, Grosskopf and Lovell (1985, pp. 3–4) a producer is said to be technically efficient if production occurs on the boundary of the producer's production possibilities set, and technically inefficient otherwise.

Allocative (or price) efficiency refers to the proper (or improper) choice of input combinations, given economic signals. A producer is said to be allocatively efficient if production occurs in a subset of the economic region of the production possibilities set that satisfies the producer's behavioral objective. The location of this subset is determined by the prices faced by the producer and the producer's behavioral goals. A technically efficient producer may be allocatively inefficient if production occurs at the wrong point on the boundary of the economic region of the production possibilities set, where "wrong" is in relation to prices faced by the producer and the producer's behavioral goal.

Technical and allocative efficiency, taken together, contribute to the overall economic efficiency for the firm. If the firm is producing on the production frontier, using the optimal proportions of inputs given relative prices and the firm's behavioral goal, the firm is said to be economically efficient. The product of the index of technical efficiency and the index of allocative efficiency is a measure of economic efficiency of the firm. A firm that is efficient both technically and allocatively has an economic efficiency index of 1.0 (Farrell, 1957).<sup>2</sup>

A fundamental decision in empirically measuring economic efficiency is the choice of producer behavioral assumption. The two economic efficiency concepts most commonly assumed in empirical analysis are cost and profit efficiencies. Economic efficiency based on a profit function measures how close a co-operative is to producing the maximum possible profit given a particular level of input prices and output prices. Conversely, economic efficiency based on a cost function measures the degree to which a co-operative's cost is close to the minimum, given input prices and output level.

Taking the level of co-operative processor output as given, the profit or welfare maximization problem for the co-operative reduces to minimizing short-run total cost. Hence, the cost function approach may be an

appropriate efficiency concept. This study focuses on the cost efficiency for co-operative firms, defined as the ratio of the minimum (or efficient) cost of producing the output for the firm in question to the actual cost at given input prices and technology. Using the standard cost function,  $C(y;w) = \text{Min}\{x.w|x \in L(y)\}$ , cost efficiency can be defined as:  $CE(x,y;w) = C(y;w)/xw$ , where  $y$  is output,  $w$  is a vector of prices of inputs,  $x$  is a vector of inputs, and  $L(y)$  is the input requirement set formed by the isoquant of the desired  $y$ . The measure of cost efficiency is bounded between zero and unity, and achieves its upper bound if and only if a producer uses a cost-minimizing input vector.

### 2.2.1. Stochastic Frontier Model

Two major approaches have been developed for measuring efficiency: a mathematical programming approach (i.e., Data Envelopment Analysis), and an econometric approach. Both methods involve estimation of “best practice” frontiers, with the efficiency of a specific decision-making unit measured relative to the frontier. The econometric approach involves specification of a functional form for production, cost, revenue, or profit (Kumbhakar & Knox Lovell, 2000). The methodology is stochastic; firms can deviate from the frontier because they are inefficient or because of random shocks that are unrelated to efficiency. Thus, the error term associated with the frontier function is hypothesized to consist of an efficiency component and a purely random component. Efficiency is measured by separating the efficiency component from the overall error term. By contrast, the mathematical programming approach places less structure on the frontier and is nonstochastic; that is, any departure from the frontier is measured as inefficiency. The analysis in this study is undertaken using the econometric approach, and is based on stochastic frontier methodology developed by Aigner, Lovell, and Schmidt (1977) and Meeusen and van den Broeck (1977).

The general form of a stochastic frontier cost function for panel data may be expressed as (Kumbhakar & Lovell, 2000; Battese & Coelli, 1992):

$$C_{ft} = C(w_{ft}, y_{ft}; \beta) + (v_{ft} + u_{ft}), \quad f = 1, \dots, F, t = 1, \dots, T \quad (1)$$

where  $C_{ft}$  is the actual cost of the  $f$ th co-operative in the  $t$ th time period;  $C(w_{ft}, y_{ft}; \beta)$  denotes the theoretical cost function;  $w_{ft}$  is a  $k \times 1$  vector of input prices for the  $f$ th co-operative in the  $t$ th time period;  $\beta$  is a vector of parameters to be estimated;  $v_{ft}$  is assumed to be an independently and identically distributed  $N(0, \sigma_v^2)$  stochastic error term, and independent of  $u_{ft}$ ;  $u_{ft}$  is assumed to be an independently and identically distributed

non-negative truncation of the  $N(\mu, \sigma_u^2)$  distribution, and thus accounts for cost inefficiency in production.

The general procedure for estimating cost efficiency using Eq. (1) is to first estimate  $\beta$  and  $\varepsilon_{ft} = v_{ft} + u_{ft}$  and then to calculate cost efficiency for each observation in the sample as the conditional expectation  $E(\exp(-u_{ft})|\varepsilon_{ft})$ . This provides an estimate of cost efficiency as the ratio of frontier (i.e., efficient) cost to actual cost. If distributional assumptions are imposed on the error terms, the density function of  $\varepsilon_{ft}$ ,  $f(\varepsilon_{ft})$ , and the joint density function  $f(u_{ft}, \varepsilon_{ft})$  are first determined and then an expression for the conditional mean of  $\exp(-u_{ft})$  based on the distribution  $f(u_{ft}|\varepsilon_{ft})$  is derived. Given a truncated-normal distribution for  $u_{ft}$ , the firm-specific inefficiency term is (Jondrow, Lovell, Materov, & Schmidt, 1982):

$$E[u_{ft}|\varepsilon_{ft}] = \frac{\sigma\lambda}{1 + \lambda^2} \left[ \frac{\phi(\mu_f/\sigma\lambda - \varepsilon_{ft}\lambda/\sigma)}{1 - \Phi(\mu_f/\sigma\lambda - \varepsilon_{ft}\lambda/\sigma)} - \left( \frac{\mu_f}{\sigma\lambda} - \frac{\varepsilon_{ft}\lambda}{\sigma} \right) \right] \quad (2)$$

where  $\mu_f = \delta'z$ ,  $\sigma = \sqrt{\sigma_v^2 + \sigma_u^2}$ , and  $\lambda = \sigma_u/\sigma_v$ ,  $\mu_f$  is the mode/mean of the truncated normal distribution and  $z$  is factor affecting efficiency. Estimates of the cost efficiency ( $CE_{ft}$ ) for each observation can be obtained from:  $CE_{ft} = \exp(-\hat{u}_{ft})$ ,<sup>3</sup> where  $\hat{u}_{ft}$  is an estimate of  $E(u_{ft}|\varepsilon_{ft})$ .

Consistent with many empirical cost function studies, the stochastic translog functional form is used in this study. For firm  $f = 1, \dots, F$  at time  $t = 1, \dots, T$ , the stochastic cost function may be represented as follows (Christensen, Jorgenson, & Lau, 1973):

$$\begin{aligned} \ln(C_{ft}) = & \beta_0 + \sum_i \beta_i \ln w_{ift} + 0.5 \sum_i \sum_j \beta_{ij} \ln w_{ift} \ln w_{jft} \\ & + \sum_i \beta_{iy} \ln w_{ift} \ln y_{ft} \\ & + \ln y_{ft} + 0.5\beta_{yy}(\ln y_{ft})^2 + (v_{ft} + u_{ft}) \end{aligned} \quad (3)$$

$$u_f = \delta'z_f + \eta_f \quad (4)$$

where  $C_{ft}$  is the observed cost for the  $f$ th co-operative firm in the  $t$ th time period,  $w_{ift}$  is the price for the  $i$ th input of the  $f$ th co-operative firm in the  $t$ th time period (i.e., labor, capital and materials),  $y_{ft}$  is output (i.e., value added) for the  $f$ th co-operative firm in the  $t$ th time period,  $z_f$ 's are variables hypothesized to affect efficiency (i.e., financial leverage and firm size);  $\beta$ 's and  $\delta$ 's are parameters to be estimated, and  $v$  and  $u$  are defined as before. Eqs. (3) and (4) are estimated separately in two stages,<sup>4</sup> where the first step is

to estimate a standard stochastic frontier model (Eq. (3)), and the second step is to estimate the relationship between (estimated)  $u$  and  $z$  (Eq. (4)).

Regularity conditions require that the cost function in Eq. (3) be linearly homogeneous, nondecreasing and concave in input prices. A combination of Young's theorem and Shepherd's lemma requires that the cross effects in the set of input demand functions be symmetric as well. Linear homogeneity and symmetry are imposed using appropriate parameter restrictions on the cost function, while the nondecreasing and concavity properties are checked for the estimated functions.

Estimation of Eqs. (3) and (4) can be implemented using different stochastic frontier methods: cross-sectional, fixed or random effects, latent class stochastic frontier, and random parameters stochastic frontier approaches. In this study, the random parameters model is used, due to its ability to control for unobserved technological heterogeneity. While technology is often assumed to be homogeneous, in practice firms' technologies may be heterogeneous (Tsionas, 2002; Greene, 2002a, b, c; Orea & Kumbhakar, 2004; Huang, 2004; Battese, Rao, & O'Donnell, 2004), particularly for samples such as the one employed in the current study that include a large and heterogeneous set of agribusiness co-operative firms. Potentially unobserved technological characteristics may affect the production costs but are not necessarily indicative of different efficiencies. This heterogeneity in technology can be analyzed through specification of a model of random parameters

The general random parameters stochastic cost frontier formulation is as follows (Tsionas, 2002; Greene, 2002a, b, c; Huang, 2004):

$$\begin{aligned} C_{ft} &= C(w_{ft}, y_{ft}; \beta_f) + (v_{ft} + u_{ft}), \\ f &= 1, \dots, F, t = 1, \dots, T, v_{ft} \sim N[0, \sigma_v^2] \end{aligned} \quad (5)$$

Inefficiency distribution:

$$\begin{aligned} u_{ft} &= |u_{ft}|, u_{ft} \sim N[\mu_f, \sigma_{uf}^2] \\ \mu_f &= \delta'_f z_f \\ \sigma_{uf} &= \sigma_u \exp(\gamma'_f q_f) \end{aligned} \quad (6)$$

Parameter heterogeneity:

$$\begin{aligned} \beta_f &= \beta + \xi_\beta d_f + \Gamma_\beta v_\beta \\ \delta_f &= \delta + \xi_\delta d_f + \Gamma_\delta v_\delta \\ \gamma_f &= \gamma + \xi_\gamma d_f + \Gamma_\gamma v_\gamma \end{aligned} \quad (7)$$

where  $C_{ft}$ ,  $w_{ft}$ ,  $y_{ft}$ , and  $\beta_f$  are costs of production, input prices, output and the random parameters to be estimated, respectively, for the  $f$ th firm. The parameters  $\beta_f$  are distributed according to a  $K$ -variate normal distribution as:  $\beta_f \sim N(\bar{\beta}, \Omega)$ ,  $f = 1, \dots, F$ . where  $\bar{\beta}$  is a  $k \times 1$  vector of parameter means,  $\Omega$  is a  $K \times K$  positive definite covariance matrix.  $\beta_f | \bar{\beta}, \Omega$  are assumed to be independent. The  $d_f$  vector includes variables related to the distribution of the random parameters and these are time-invariant;  $v_{jt}$ ,  $j = \beta, \delta, \gamma$  parameterize random variation which is assumed to have mean vector zero and known diagonal covariance matrix  $\Sigma_j$ .  $\beta_f(\beta, \xi_\beta, \Gamma_\beta)$ ,  $\delta_f(\delta, \xi_\delta, \Gamma_\delta)$  and  $\gamma_f(\gamma, \xi_\gamma, \Gamma_\gamma)$  are matrices of parameters to be estimated;  $\mu_f$  is the mode/mean of truncated normal distribution;  $z_f$  are operating environmental factors affecting the inefficiency effect;  $q_f$  is operating environment variable affecting the variance of the inefficiency effects. The parameter  $\sigma_v^2$  is variance of  $v_{ft}$ , and  $\sigma_{uf}^2$  is variance of  $u_{ft}$ .

In order to estimate the parameters for Eqs. (5)–(7), the unobserved random term  $v_{jt}$  must be integrated out. Since the integrals will not exist in the closed form, but are instead in the form of expectations, they can be estimated by simulation. Thus, the simulated log likelihood is defined as

$$\begin{aligned} \text{Log } L_S &= \sum_{f=1}^N \frac{1}{R} \sum_{r=1}^R \sum_{t=1}^T \ln \frac{1}{\sqrt{2\pi}} \\ &\quad + \ln \Phi \left( \frac{\mu_{fr} / (\sigma_{ufr} / \sigma_v) \pm [(C_{ft} - C(w_{fr}, y_{fr}))(\sigma_{ufr} / \sigma_v)]}{\sqrt{(\sigma_{ufr} + \sigma_v)}} \right) \\ &\quad - \ln \Phi \left[ \frac{\mu_f}{\sigma_{ufr}} \right] - \ln \sqrt{\sigma_{ufr}^2 + \sigma_v^2} - \frac{1}{2} \left( \frac{\mu_f \pm (C_{ft} - C(w_{fr}, y_{fr}))}{\sqrt{\sigma_{ufr}^2 + \sigma_v^2}} \right)^2 \\ &= \sum_{f=1}^N \frac{1}{R} \sum_{r=1}^R \sum_{t=1}^T \log P_{ftr} \end{aligned} \tag{8}$$

The maximum simulated likelihood estimator is obtained by maximizing (8) over the full set of structural parameters (for more detail on this see Train, 2002 and Greene, 2002a, b, c). Firm-specific estimates of the parameters,  $\theta_f[\beta_f(\beta, \xi_\beta, \Gamma_\beta)$ ,  $\delta_f(\delta, \xi_\delta, \Gamma_\delta)$ , and  $\gamma_f(\gamma, \xi_\gamma, \Gamma_\gamma)$ ] are required in order to estimate cost efficiency. Greene, (2002a, b, c) suggests an estimate of the posterior, conditional mean, for the parameter estimates



as follows:

$$\hat{\theta}_f = \frac{1/R \sum_{r=1}^R \theta_{fr} \exp\left(\sum_{t=1}^T \log P_{ftr}\right)}{1/R \sum_{r=1}^R \exp\left(\sum_{t=1}^T \log P_{ftr}\right)} = \frac{1/R \sum_{r=1}^R P_{fr} \theta_{fr}}{1/R \sum_{r=1}^R (P_{fr})} \quad (9)$$

where  $R$  is the number of repetitions (i.e., draws of  $m$ ) on  $m_{jf}$ ,  $P_{ft}$  is the (probability) contribution of the  $f$ th co-operative at time period  $t$  to the likelihood. This can also be computed by simulation during computation of the likelihood function. The firm-specific inefficiencies are then based on firm-specific expected values of the random parameters.

### 2.3. Data Description

The costs of production, wages and salaries, number of full-time and part-time employees, volume of sales, costs of goods sold, long-term debt, number of members, assets, liabilities and other financial data are obtained from the annual surveys of agribusiness co-operatives conducted by the Co-operatives Secretariat (CCS), Government of Canada. Of the more than 1,300 total agriculture-based co-operatives, approximately 900 reported to the Co-operatives Secretariat in 2001. Of that number, approximately 150–170 (varies by year) reporting co-operatives were agricultural marketing co-operatives. Since the number of observations for most co-operative types (e.g., honey and maple, poultry, greenhouse, livestock and other) is low, only grain and oilseed, dairy and fruit and vegetable co-operatives are used.

This study focuses on an unbalanced panel of 14 grain and oilseed, 28 dairy and 54 fruit and vegetable marketing co-operatives over the period 1984–2001. Data for the GDP deflator, fixed-investment deflator, interest rate, raw material price indices and farm input price indices are gathered from Statistics Canada (CANSIM) for the period 1984–2001.

#### 2.3.1. Raw Material/Farm Input Prices ( $M$ )

Raw materials are treated as an aggregate input, excluding capital and labor which are dealt with separately. Raw material price indices are collected from the Statistics Canada database, CANSIM. Cost of goods sold is used as a proxy for the value of raw materials.

### 2.3.2. Capital Price ( $K$ )

According to the opportunity cost principle, the unit cost of capital for a firm should be calculated as the rental value of the capital stock, as if the capital were being rented. The capital input group is an aggregate of land, buildings, machinery, and equipment. Using the GDP Deflator and fixed capital price index, the relative price of one unit of capital with respect to production  $q$ , is calculated for Canada for each year.<sup>5</sup> In this study, per unit user cost of capital ( $r_k$ ) is calculated as  $r_k = (i - \pi + \delta)q$ , where  $i$  is the opportunity cost of capital,  $\delta$  is the capital depreciation rate,  $q$  is the acquisition of capital, and  $\pi$  is the rate of inflation in the economy.

### 2.3.3. Price of Labor ( $L$ )

The labor input consists of full-time and part-time labor. Both the number of employees and the total salary and wages are available from the sample data, but with a high incidence of measurement errors. The per hour wage rate is calculated assuming 40 working hours per week. Where there are outliers, the data are truncated at \$25 per hour from above and \$10 per hour from below based on aggregate wage information from Statistics Canada.

### 2.3.4. Output ( $y$ )

The output variable represents value added (sales minus cost of goods sold). One of the challenges in estimating cost frontiers for fruit and vegetable-marketing co-operatives is that the direct measure of output ( $y$ ) is difficult if not impossible to quantify accurately. Thus, value added is used as a proxy for  $y$ .

### 2.3.5. Total Cost ( $C$ )

The total cost represents the sum of expenses for materials, labor, and capital for the firm. Prior to estimation, value added and all price indexes are normalized to one at the mean of the pooled sample.

### 2.3.6. Debt to Asset Ratio ( $D/A$ )

Debt to asset ratio is used as a measure of the degree of financial leverage.

### 2.3.7. Volume of Sales

Volume of sales is used as a proxy for co-operative size. Other firm size indicators used in the literature include dollar value of assets and the number of employees. Table 2 provides descriptive statistics for the unbalanced

**Table 2.** Descriptive Statistics (Mean) for Agricultural Supply and Marketing Co-operatives by Activity (1984–2001).

Co-op Activities	Total Costs (Million \$)	Sales (Million \$)	Cost of Good Sold (Million \$)	Value Added (Million \$)	Return on Assets	Debt to Assets Ratio	Total Assets (Million \$)	Employees (#)	Members (#)
Dairy ( <i>n</i> * <i>t</i> = 334)	141.781 (288.960)	153.909 (298.849)	126.225 (262.702)	27.684 (49.176)	0.058 (0.095)	0.4807 (0.194)	49.829 (97.903)	401 (721)	1333 (1,661)
Fruit ( <i>n</i> * <i>t</i> = 213)	5.783 (7.248)	7.975 (10.301)	4.375 (5.662)	3.600 (6.237)	0.075 (0.188)	0.6085 (0.279)	3.884 (5.807)	24 (52)	117 (122)
Vegetable ( <i>n</i> * <i>t</i> = 250)	7.174 (8.823)	8.710 (11.463)	6.089 (7.596)	2.621 (4.636)	0.034 (0.148)	0.6909 (0.247)	3.057 (4.505)	24 (41)	95 (177)
Grain and Oilseed ( <i>n</i> * <i>t</i> = 157)	668.742 (973.593)	704.935 (1,016.699)	630.702 (921.987)	74.234 (110.371)	0.019 (0.105)	0.6118 (0.170)	237.273 (383.334)	731 (1,084)	23571 (32982)

*Note:* Figures in parentheses are standard deviations. *n*\**t* refers to the number of observations. Note that the overall number of observations is greater than the individual industry sum as other categories are also included in the overall statistics.

sample observations of fruit and vegetable marketing co-operatives over the period 1984–2001.

### 2.3.8. Number of Members

Number of members is used to control for the impact of member diversity on the performance of the co-operative.

## 2.4. Model Results

The stochastic frontier models in this study are estimated using a maximum simulated likelihood routine in LIMDEP (NLOGIT 3.0.1/14). To address the problem of determining the best model to estimate firm level cost (in)efficiency, formal model selection criteria and theoretical information based on the nature of data are used. A statistical test is conducted to establish if the observed technological differences matter in the estimation of frontier cost functions. For example, given the heterogeneity among the sample firms in terms of observed technological differences across firms in different industries, estimation of separate frontiers for each industry may be appropriate. From a theoretical as well as a practical point of view, estimating the same cost frontier for firms in different industries as if they use the same technology does not make economic sense (e.g., firms from dairy co-operatives and grain co-operatives have completely different technologies). In addition, these industries operate under different regulatory structures. Thus, it is imperative to estimate a separate frontier for each industry. However, to support this economic intuition, statistical tests are conducted to see whether or not the firms from different industries should be aggregated into one group. In the following sections, various model tests are conducted. To account for the unobserved technological differences among co-operative firms in the same industry, the random parameters stochastic frontier model is used.

### 2.5. Observed Heterogeneity in Technology

Formal statistical tests are conducted to investigate whether or not to estimate a single frontier for the co-operative sector as a whole or to estimate a separate frontier for each industry. Thus, models with (i.e.,  $\beta_{fi} = \beta + \xi_{\beta}dairy_f + \xi_{\beta}grain_f + \xi_{\beta}fruit_f + \Gamma_{\beta}m_{\beta f}$ ) and without (i.e.,  $\beta_{fi} = \beta + \Gamma_{\beta}m_{\beta f}$ ) heterogeneity in mean are estimated and compared using a likelihood ratio test, where  $dairy_f = 1$  if the firm is from dairy industry, 0 otherwise;

$\text{grain}_f = 1$  if the firm belongs to grain industry, 0 otherwise;  $\text{fruit}_f = 1$  if the firm belongs to fruit and vegetable industry, 0 otherwise. The log-likelihood function (LLF) values for the models with and without heterogeneity in the mean of the random parameters are  $-659.952$  and  $-699.173$ , respectively. The calculated  $\chi^2$  value is  $84.44$  whereas the critical  $\chi^2$  value is  $31.410$  for 20 degrees of freedom at the 95 per cent confidence level. Consistent with the intuitive claim, this result suggests that there are real differences in technology between firms in different industries. Thus, pooling firms from different industries into a single frontier analysis is inappropriate. Based on these results, frontiers for the three types of marketing co-operatives (i.e., one each for dairy, grains, and fruit and vegetable) are estimated separately.

### *2.6. Unobserved Heterogeneity in Technology*

In this section, a comparison of the random parameters model (heterogeneous technology model) and the random effects frontier model (homogeneous technology model) is conducted based on statistical tests. Model selection between the homogenous (i.e., random effects) technology frontiers and heterogeneous technology frontiers is conducted for the three agricultural marketing co-operatives. Since the two models are non-nested in each other, appropriate (i.e., non-nested) model selection tests are used. The Akaike Information Criterion (AIC) and Bayes Information Criterion (BIC) are used to select the best model.

Based on these criteria, the best model is the one with the lowest AIC/BIC value. Table 3 presents the LLF, AIC, and BIC values and the corresponding means and standard deviations of cost efficiency scores. Based on the AIC and BIC values, the random parameters model best fits the sample data. Thus, random parameters models are considered for further analysis of cost efficiency. The superiority of the random parameters model is consistent with the findings of Tsionas (2002), Caudill (2003), Orea and Kumbhakar (2004), among others.

The differences in estimated cost efficiency are also presented in the bottom two rows of Table 3. The results suggest that cost efficiency scores differ among the estimated models, and are higher for the random parameters model implying that efficiency scores are higher under the assumption of heterogeneous technology. Thus, the unobserved technological heterogeneity matters in the estimation of cost efficiency suggesting that part of estimated cost inefficiencies may be unobserved technological differences. These results are consistent with what has been obtained in previous studies using

**Table 3.** Tests Results for Model Selection between Homogeneous Technology and Heterogeneous Technologies Stochastic Frontier Models and the Associated Mean Efficiency Scores.

	Homogeneous Technology (Random Effects)			Heterogeneous Technologies (Random Parameters without Heterogeneity)		
	Dairy	Grains	Fruit and vegetable	Dairy	Grains	Fruit and vegetable
LLF	-245.849	-53.283	-416.199	-175.361	-9.027	-356.495
AIC	517.698	132.565	858.397	396.723	64.054	758.990
BIC	567.243	172.296	912.187	484.379	134.347	854.158
Mean cost efficiency	0.288	0.046	0.116	0.746	0.839	0.738
SE of cost efficiency	0.182	0.121	0.200	0.120	0.085	0.097

heterogeneous technology models (e.g., Tsionas, 2002; Orea & Kumbhakar, 2004; Huang, 2004). For example, Huang found that the posterior means of efficiency measures were higher for a random parameters model (i.e., 99.5 per cent) than those obtained for the fixed parameters case (i.e., 67.1 per cent).

To take into account the observed heterogeneity across firms in different industries, a separate cost frontier is estimated for each industry. At the same time, to account for unobserved technological differences across firms in the same industry, the random parameters stochastic frontier is implemented. The cost structures and efficiencies of (i) dairy co-operatives; (ii) grain and oilseed co-operatives; and (iii) fruit and vegetable co-operatives, over the period 1984–2001, are explored and presented individually using the random parameters stochastic frontier model. Since data on industry level time invariant variables (e.g., location) are not available the random parameters model without heterogeneity in means (i.e.,  $\beta_{fi} = \beta + \Gamma_{\beta} m_{\beta_f}$ ) is estimated in each industry.

### 3. DAIRY, GRAIN AND FRUIT AND VEGETABLE MARKETING CO-OPERATIVES

In this section, the cost structures and cost efficiencies are presented and discussed individually for each of the three individual frontiers. Since there are two major types of products that are handled by the fruit and vegetable co-operatives (and the data for these attributes are also available), two separate random parameters models are estimated and tested: with (i.e.,  $\beta_{fi} = \beta + \xi_{\beta} \text{fruit}_f + \Gamma_{\beta} m_{\beta_f}$ ,  $\text{fruit} = 1$ , for fruit co-operatives;  $\text{fruit} = 0$ , for vegetables co-operative) and without (i.e.,  $\beta_{fi} = \beta + \Gamma_{\beta} m_{\beta_f}$ ) heterogeneity in the means of the random parameters. A likelihood ratio test is conducted to select the best model (Table 4). At a 90 per cent confidence level, the random parameters model without heterogeneous means is rejected in favour of the random parameters model with heterogeneity in the means.

#### *3.1. Parameter Estimates for Dairy, Grain, and Fruit and Vegetable Co-operatives<sup>6</sup>*

As stated earlier, to allow for unobserved heterogeneity across firms, random parameters stochastic frontier models are used to measure firm efficiency of 28 dairy, 14 grain, and 54 fruit and vegetable-marketing co-operatives over the period 1984–2001. The simulated maximum log-likelihood parameter estimates for dairy, grains, and fruit and vegetable co-operatives' stochastic

**Table 4.** Tests Results for Model Selection between Heterogeneous Technologies Stochastic Cost Frontier Model without and without Heterogeneity in the Means of the Random Parameters for Fruit and Vegetable Co-operatives in Canada, 1984–2001.

	Without Heterogeneity	With Heterogeneity
AIC	758.990	761.440
BIC	854.158	897.985
LLF	−356.495	−347.720
Number of parameters	23	33
Likelihood ratio	17.551	
Critical $\chi^2$ value (5 per cent, 30 df)	18.307	
Critical $\chi^2$ value (10 per cent, 30 df)	15.987	
Mean of cost efficiency	0.738	0.720
Standard deviation of cost efficiency	0.097	0.117

frontier models, with a half-normal distributional assumption, are given in Tables 5 and 6.

The results in Tables 5 and 6 are based on 100 draws of the Halton sequence simulation. With the exception of the coefficient for the time variable,  $\sigma_u$ ,  $\sigma_v$ ,  $\sigma$ , and  $\lambda$ , all other parameters are random. As noted earlier, estimation of a cost function assumes certain regularity conditions. Homogeneity in input prices and symmetry are imposed prior to estimation. Monotonicity is checked at the mean value of the estimated input cost shares. At the mean value, material, labor and capital cost shares are all greater than zero suggesting that on average the data fulfill the monotonicity condition. Concavity of the cost function is checked by evaluating the negative semidefiniteness of the Hessian matrix at the mean value. The partial elasticities of substitution are calculated as:  $\sigma_{ii} = (\beta_{ii} + S_{ii}^2 - S_{ii})/S_{ii}^2$ ,  $i = i$ th input; and  $\sigma_{ij} = (\beta_{ij} + S_{ii}S_{jj})/S_{ii}S_{jj}$ ,  $i, j = i$ th,  $j$ th input ( $i \neq j$ ). All eigenvalues should be less than or equal to zero for the concavity condition to be fulfilled. For the grain and fruit and vegetable models, all the eigenvalues are less than zero indicating that the curvature condition is satisfied at the mean value of the data. For the dairy model, one of the eigenvalues is greater than zero suggesting a violation of the concavity condition.

### 3.2. Efficiency Measurements for Dairy and Grain Co-operatives

One of the main objectives of this study is to explore the nature of cost efficiency among agricultural co-operatives in Canada. Once the frontier



**Table 5.** Parameter Estimates for Random Parameters Stochastic Cost Frontier Model for Dairy and Grain Marketing Co-operatives in Canada, 1984–2001.

		Dairy		Grain	
Mean of constant	$\beta_0$	17.908***	(0.243)	16.553***	(0.047)
Std. deviation	$\Gamma_{\beta 0}$	1.240***	(0.023)	1.471***	(0.036)
Mean of material	$\beta_M$	3.260***	(0.558)	0.900***	(0.128)
Std. deviation	$\Gamma_{\beta M}$	0.763***	(0.054)	0.013	(0.080)
Mean of labour	$B_L$	0.322***	(0.073)	0.180***	(0.056)
Std. deviation	$\Gamma_{\beta l}$	0.501***	(0.054)	0.041	(0.059)
Mean of value added	$\beta_V$	0.508***	(0.012)	0.802***	(0.010)
Std. deviation	$\Gamma_{\beta V}$	0.169***	(0.007)	0.327***	(0.010)
Mean of material <sup>2</sup>	$\beta_{MM}$	-0.231	(1.042)	-0.558	(0.578)
Std. deviation	$\Gamma_{\beta MM}$	1.498***	(0.390)	0.616	(0.402)
Mean of material*labour	$\beta_{MW}$	1.199***	(0.355)	-0.571*	(0.352)
Std. deviation	$\Gamma_{\beta MW}$	0.267	(0.179)	0.348	(0.283)
Mean of labour <sup>2</sup>	$B_{LL}$	-1.087***	(0.387)	-0.126	(0.260)
Std. deviation	$\Gamma_{Bll}$	0.982***	(0.174)	0.995***	(0.209)
Mean of material*value	$\beta_{MV}$	-0.138***	(0.041)	0.015	(0.039)
Std. deviation	$\Gamma_{\beta MV}$	1.013***	(0.044)	0.145***	(0.034)
Mean of labour*value	$B_{LV}$	-0.093***	(0.033)	-0.063***	(0.018)
Std. deviation	$\Gamma_{\beta LV}$	0.156***	(0.025)	0.064***	(0.022)
Mean of value <sup>2</sup>	$\beta_{VV}$	-0.192***	(0.007)	0.109***	(0.006)
Std. deviation	$\Gamma_{\beta VV}$	0.043***	(0.004)	0.114***	(0.006)
Time	$\beta_T$	-0.063***	(0.019)	0.023***	(0.003)
$\sigma$		0.444***	(0.011)	0.260***	(0.011)
$\lambda$		1.970***	(0.168)	1.962***	(0.252)
$\sigma_u$		0.396		0.232	
$\sigma_v$		0.201		0.118	
LLF		-175.361		-9.027	
AIC		396.723		64.054	
BIC		484.379		134.347	
$N$		28		14	
$N*T$		334		157	

Note: Figures in parentheses are standard deviations.

\*Significance at a 10 per cent level.

\*\*\*Significance at a 1 per cent level.

cost function is estimated the next step is to calculate individual firm level cost efficiencies. The maximum likelihood estimates for the  $\lambda$ -parameters are 1.970, 1.962, and 2.061 for dairy, grain, and fruit and vegetable, respectively (Tables 5 and 6). These are statistically significant at a 95 per cent confidence level indicating that there is significant interfirm cost efficiency variability in

**Table 6.** Parameter Estimates for Random Parameter Stochastic Cost Frontier Model for Fruit and Vegetable Marketing Co-operatives in Canada, 1984–2001.

Variables	Posterior Means for Random parameters ( $\beta$ 's)		Posterior Heterogeneity in the means (Fruit Dummy) – ( $\xi$ 's)		Posterior Standard Deviation of Random Parameters ( $\Gamma_{\beta}$ 's)	
Constant	14.568***	(0.078)	–0.307***	(0.078)	1.121***	(0.020)
Raw	0.351	(0.340)	–1.745***	(0.411)	0.519***	(0.082)
Labour	0.432***	(0.121)	–0.281**	(0.142)	0.160***	(0.028)
Value added	0.555***	(0.037)	–0.345***	(0.044)	0.269***	(0.006)
Raw <sup>2</sup>	–0.409	(1.674)	–5.817***	(2.240)	0.711	(0.704)
Raw*labour	–0.045	(0.485)	0.229	(0.664)	1.209***	(0.227)
Labour <sup>2</sup>	–1.733***	(0.522)	2.832***	(0.639)	1.373***	(0.142)
Raw*value	0.062	(0.113)	–0.203	(0.140)	0.033	(0.029)
Labour*value	0.188***	(0.055)	–0.160***	(0.064)	0.149***	(0.011)
Value <sup>2</sup>	0.036***	(0.014)	–0.021	(0.017)	0.109***	(0.003)
Time	0.024***	(0.003)	–	–	–	–
$\sigma_u$	0.460					
$\sigma_v$	0.223					
$\sigma$	0.511***	(0.008)				
$\lambda$	2.061***	(0.100)				
LLF	–347.720					
Firms	54					
$N$	463					
Halton draws	200					

Note: Figures in parentheses are standard deviations.

\*\*Significance at a 5 per cent level.

\*\*\*Significance at a 1 per cent level.

**Table 7.** Distribution of Cost Efficiency for Dairy and Grains Marketing Co-operatives in Canada.

Activity	Mean	Std. Dev.	Minimum	Maximum	CV
Dairy	0.746	0.120	0.309	0.946	0.161
Grain	0.839	0.085	0.488	0.965	0.101
Fruit and vegetable	0.720	0.117	0.032	0.959	0.163

each industry. Given the estimates of  $\sigma_u$  and  $\sigma_v$ , approximately 80 per cent, 79 per cent, and 81 per cent of the variability in the stochastic frontier models for dairy, grain, and fruit and vegetable (respectively) is due to their cost inefficiency components.<sup>7</sup> Summary statistics for the cost efficiency estimates based on the random parameters stochastic frontier model are given in Table 7.

Based on the random parameters stochastic frontier model estimates, the cost efficiency of dairy marketing co-operatives ranges between 30.9 per cent and 94.6 per cent with a mean of 74.6 per cent. For grain marketing co-operatives, the cost efficiency ranges between 48.8 per cent and 96.5 per cent with a mean of 83.9 per cent. The mean cost efficiency of the 54 fruit and vegetable marketing co-operatives is estimated to be 72.0 per cent. This level of cost efficiency is relatively lower than that for dairy and grain marketing co-operatives. There is more variability in cost efficiency among firms in the dairy industry (0.120) and fruit and vegetable industry (0.117) than among firms in the grains industry (0.085) (Table 7). There is not much difference in the degree of variation in efficiency between dairy and fruit and vegetable co-operatives. For example, for dairy co-operatives in India, Singh et al. (2001) estimated an overall average efficiency of 0.667 using data envelopment analysis approach.

### 3.3. Effect of Financial Leverage of Efficiency for Dairy and Grain Co-operatives

A summary of average dairy marketing co-operatives sample observation characteristics by efficiency category is provided in Table 8. In general, for the majority of large dairy co-operative sample observations, the efficiency scores range between 70 and 80 per cent. Based on descriptive statistics, there is no obvious relationship between small size dairy co-operative sample observations and their efficiency scores. Some of the small dairy co-operative sample observations are found to be the least efficient while

**Table 8.** Panel Average Dairy Marketing Co-operative Sample Observations Characteristics by Cost Efficiency Index Categories in Canada.

Characteristics	Efficiency Scores						Mean
	<0.50	0.5–0.59	0.60–0.69	0.70–0.79	0.80–0.89	> 0.89	
Cost <sup>a</sup>	102.924	141.131	136.688	161.241	131.369	100.008	141.781
Sales <sup>a</sup>	103.055	141.765	140.802	180.081	143.271	108.958	153.909
Value added <sup>a</sup>	5.772	12.398	18.014	39.056	25.009	21.333	27.684
Assets <sup>a</sup>	34.828	49.341	36.770	59.270	47.637	37.078	49.829
ROA <sup>b</sup>	0.016	0.023	0.039	0.067	0.069	0.064	0.058
DTA <sup>b</sup>	0.627	0.531	0.479	0.465	0.469	0.454	0.481
Employees <sup>c</sup>	126	292	314	516	372	320	401
Members <sup>c</sup>	953	1041	1421	1692	1069	513	1333
<i>N</i>	18	23	44	135	98	16	334

ROA = return on assets; DTA = debt to asset ratio; and *N* = number of observations in a panel.

<sup>a</sup>Million Canadian dollars.

<sup>b</sup>Ratio.

<sup>c</sup>Number.

others are the most efficient. Dairy co-operative sample observations with lower reliance on debt (i.e., lower debt to assets ratio) appear to be more cost efficient as compared to those with higher debt financing. This result may suggest that dairy co-operative sample observations with higher leverage are less cost competitive.

Table 9 presents the relationship between average sample observation characteristics and their efficiency for grain marketing co-operatives. Grain co-operative sample observations with large sales volume and large asset values tend to be less efficient. Consistent with results for dairy co-operative sample observations, grain co-operative sample observations with low debt financing and high return to assets tend to be more efficient. Again, the fact that debt financing has a negative “relationship” with efficiency may suggest that efficiency decreases with increases in the degree of financial leverage.

Table 10 presents the relationship between average sample observations characteristics and their efficiency for fruit and vegetable-marketing co-operatives. For fruit and vegetable co-operatives, sample observations with large sales values are characterized by lower efficiency. However, there is no definite relationship between asset values and efficiency for fruit and vegetable co-operative sample observations. The relationship between leverage

**Table 9.** Panel Average Grain Marketing Co-operative Sample Observations Characteristics by Cost Efficiency Indices Categories in Canada.

Characteristics	Efficiency Scores					Mean
	0.5–0.59	0.60–0.69	0.70–0.79	0.80–0.89	> 0.89	
Cost <sup>a</sup>	1641.202	966.661	792.426	532.839	717.516	668.742
Sales <sup>a</sup>	1633.213	1000.983	831.392	565.430	768.335	704.935
Value added <sup>a</sup>	80.954	87.951	78.000	64.180	93.655	74.233
Assets <sup>a</sup>	654.390	323.839	237.055	198.993	254.165	237.273
ROA <sup>b</sup>	-0.069	-0.001	0.024	0.031	0.005	0.019
DTA <sup>b</sup>	0.696	0.709	0.625	0.593	0.616	0.612
Employees <sup>c</sup>	1398	881	821	617	826	731
Members <sup>c</sup>	29508	28078	23943	21662	26342	23571
<i>N</i>	5	8	24	87	33	157

ROA = return on assets; leverage = debt to asset ratio; and *N* = number of observations in a panel.

<sup>a</sup>Million Canadian dollars.

<sup>b</sup>Ratio.

<sup>c</sup>Number.

**Table 10.** Panel Average Fruit and Vegetable Co-operative Sample Observations Characteristics by Efficiency Indices Categories, 1984–2001.

Characteristics	Efficiency Scores						Mean
	<0.50	0.5–0.59	0.60–0.69	0.70–0.79	0.80–0.89	> 0.89	
Cost <sup>a</sup>	9.825	8.868	8.104	5.961	4.769	2.182	6.534
Sales <sup>a</sup>	10.571	10.357	9.621	7.880	7.130	4.492	8.372
Value added <sup>a</sup>	1.403	3.025	2.910	3.186	3.379	3.718	3.071
Assets <sup>a</sup>	2.243	3.727	3.722	3.570	2.916	5.110	3.437
ROA <sup>b</sup>	0.049	0.027	0.033	0.057	0.071	0.092	0.052
Leverage <sup>b</sup>	0.637	0.713	0.682	0.641	0.629	0.656	0.653
Employee <sup>c</sup>	10	18	22	27	25	35	24
Member <sup>c</sup>	82	116	131	102	86	106	105
<i>N</i>	24	35	104	192	99	9	463

ROA = return on assets; leverage = debt to asset ratio; and *N* = number of observations in a panel.

<sup>a</sup>Million Canadian dollars.

<sup>b</sup>Ratio.

<sup>c</sup>Number.

and efficiency is ambiguous as well. In general, observations with higher return on assets appear to be more efficient as compared to those with lower returns. Sample observations with larger numbers of employees are more efficient.

Given the descriptive relationship between efficiency scores and financial leverage and firm size, the next step is to rigorously (i.e., statistically) investigate which factors are related to efficiency differences across observations for these firms. Tables 11–13 provide the random parameters Tobit regression parameter estimates for the determinants of cost efficiency for dairy, grain, and fruit and vegetable-marketing co-operatives, respectively. The results indicate that firm size, as measured by the number of employees, is positively and significantly related to cost efficiency of dairy and fruit and vegetable co-operatives. This suggests that cost efficiency increases with size.<sup>8</sup> For grain marketing co-operatives, the relationship between cost efficiency and firm size is negative and statistically significant.<sup>9</sup>

Technological theories emphasize physical capital and economies of scale and scope as factors that determine optimal firm size and, by implication, efficiency (Kumar, Rajan, & Zingales, 2002). These theories focus on the production process and the investment in physical capital necessary to produce output. Increasing economies of scale that permit fixed costs to be spread over large output volumes, thereby decreasing the average cost of production are associated with increases in firm size. If economies of scale

**Table 11.** Random Parameter Tobit Regression Parameters Estimates for the Determinants of Cost Efficiency for Dairy Marketing Co-operatives in Canada, 1984–2001.

Variables		Debt to Asset Ratio		Debt to Equity Ratio	
Mean constant	$\delta_0$	0.748***	0.004	0.745***	0.004
STD. deviation constant	$\Gamma_{\delta 0}$	0.046***	0.004	0.044***	0.004
Mean debt leverage	$\delta_L$	-0.033***	0.004	-0.054***	0.007
Std. deviation debt leverage	$\Gamma_{\delta L}$	0.019***	0.004	0.039***	0.006
Number of members	$\beta_M$	-0.027***	0.005	-0.026***	0.005
Number of employees	$\beta_E$	0.032***	0.005	0.028***	0.005
$\sigma$		0.106***	0.001	0.107	0.001
LLF		259.67		253.22	
$\chi^2$		519		506.45	
$N$		334		334	
Firms		28		28	

Note: Figures in parentheses are standard deviations.

\*\*\*Significance at a 1 per cent level.

**Table 12.** Random Parameter Tobit Regression Parameters Estimates for the Determinants of Cost Efficiency for Grain Marketing Co-operatives in Canada, 1984–2001.

Variables		Debt to Asset Ratio		Debt to Equity Ratio	
Mean constant	$\delta_0$	0.839***	0.005	0.839***	0.005
STD. deviation constant	$\Gamma_{\delta_0}$	0.0005	0.005	0.0003	0.005
Mean debt leverage	$\delta_L$	-0.017***	0.005	-0.006***	0.006
Std. deviation debt leverage	$\Gamma_{\delta_L}$	0.00004	0.005	0.00006	0.009
Number of members	$\beta_M$	0.044***	0.017	0.039***	0.017
Number of employees	$\beta_E$	-0.052***	0.018	-0.046***	0.018
$\sigma$		0.082***	0.002	0.083***	0.002
LLF		170.49		167.85	
$\chi^2$		340.98		335.707	
$N$		157		157	
Firms		14		14	

Note: Figures in parentheses are standard deviations.

\*\*\*Significance at a 1 per cent level.

**Table 13.** Random Parameter Tobit Regression Parameters Estimates for the Determinants of Cost Efficiency for Fruit and Vegetable Marketing Co-operatives in Canada, 1984–2001.

Variables		Debt to Asset Ratio		Debt to Equity Ratio	
Mean constant	$\delta_0$	0.717***	0.004	0.720***	0.004
STD. deviation constant	$\Gamma_{\delta_0}$				
Mean debt leverage	$\delta_L$	-0.009***	0.003	0.006	0.005
Std. deviation debt leverage	$\Gamma_{\delta_L}$	0.026	0.004	0.0005	0.004
Number of members	$\beta_M$	-0.006*	0.004	-0.004	0.004
Number of employees	$\beta_E$	0.012***	0.004	0.010**	0.004
$\sigma$		0.113	0.002	0.116	0.002
LLF		342.445		339.89	
$\chi^2$		684.89		679.77	
$N$		463		463	
Firms		54		54	

Note: Figures in parentheses are standard deviations.

\*Significance at a 10 per cent level.

\*\*Significance at a 5 per cent level.

\*\*\*Significance at a 1 per cent level.

cease to exist, then at that point bigger is no longer better, at least in terms of lowering production costs and improving efficiency. Organizational theories of the firm grounded in transaction costs (Williamson, 1985), agency costs (Jensen & Meckling, 1976) and span of control costs also predict that at some point average per unit transaction and agency costs would increase and offset economies of scale and scope thus establishing an optimal size for the firm in terms of efficiency or profitability.

The basic implication of technological and organizational theories emphasizing transaction and agency<sup>10</sup> costs of firm size is that within a specific industry (common production technology) and within a common institutional environment, firm size and efficiency may be linked through a trade-off of economies of scale and transactions costs and agency costs.

To explore the impact of debt leverage, two measures of financial leverage are used: total debt to asset ratio and total debt to equity ratio. For debt to asset ratio models, financial leverage is significantly and negatively related to cost efficiency of dairy, grain marketing, and fruit and vegetable co-operatives. For the sample firms, this suggests that cost efficiency decreases as the degree of financial risk increases. This result is also consistent with agency theory that states that agency costs due to conflicts of interests increase with the level of debt (Jensen & Meckling, 1976). For debt to equity ratio models, similar results are found for dairy and grain co-operatives. For fruits and vegetable co-operatives, the coefficient of debt to equity ratio is statistically insignificant. These results are consistent with financial leverage impact studies that firms may be operating at various levels of cost inefficiency due to differences in capital structures (Nasr, Barry, & Ellinger, 1998; Rajan & Zingales, 1995; Johnson, 1997; Michaelas, Chittenden, & Poutziouris, 1999). From the above, a substantial number of dairy and grain marketing co-operatives could be more efficient by adjusting their size and capital structure.

To capture the impact of membership diversity on efficiency of individual co-operatives, the number of members is incorporated. Results for co-operatives in dairy and grain industries suggest that cost efficiency decreases with increased number of members. Mosheim (2002) found that membership size had a negative impact on scale efficiency and a positive effect on allocative, technical, and cost efficiencies. Albaek and Schultz (1997) showed that for co-operatives with many members (small or large), efficiency will not prevail if the investment cost is equally shared among members with different levels of patronage. Furthermore, Grossman and Hart (1988) argue that efficiency may require that votes be distributed according to “the size of patronage”. Growth in membership, and ultimately in firm size, may conflict with the governance and stability of the co-operative organization.



According to Zueli (1999), “a larger, more diverse membership often leads to governance problem. Are all groups represented ...?” (p. 1236).

#### 4. CONCLUDING REMARKS

In this paper the cost structure and cost efficiency for an unbalanced sample of 96 agribusiness marketing co-operatives in Canada (14 grain and oilseed, 28 dairy marketing, and 54 fruit and vegetable-marketing co-operatives) over the period of 1984–2001 is explored using random parameters stochastic frontier models. Separate cost frontiers are estimated for agricultural marketing co-operatives in the three industries (i.e., dairy, oilseeds and grain, fruit and vegetable). The parameter estimates of the cost frontier and the resulting cost efficiency scores indicate that there are statistically and economically significant cost inefficiencies in each industry: that is, average cost inefficiency of 25 per cent for dairy marketing co-operatives, 16 per cent for grain marketing co-operatives, and 28 per cent for fruit and vegetable-marketing co-operatives.

This evidence suggests that there may be significant potential for reducing the cost of adding value to co-operative members’ outputs and/or providing services to co-operative members without loss in value added or cutback in services provided. For example, the cost of adding value for dairy marketing co-operatives would have been decreased by approximately 25 per cent, on average, had the co-operatives operated at their respective frontiers, while producing the same level of output. Thus, decision makers may focus on using resources of their co-operatives (i.e., labor, capital, and material) more efficiently in addition to focusing on increasing their size.

The following conclusion may be made. Given the empirical evidence for the sample firms: (i) the approach used to estimate cost efficiency is important; (ii) the estimated cost inefficiencies are statistically significant for all categories investigated in this study; (iii) there are significant interfirm and interindustry variations in cost efficiency; (iii) higher financial leverage has likely contributed to cost inefficiencies for dairy and grains co-operatives; and for fruit and vegetable co-operatives when debt to asset ratio is used; and (iv) larger dairy and fruit and vegetable co-operatives, and smaller grain co-operatives tend to be more cost efficient.

What is causing efficiency to change with firm size? To answer this question further empirical research is warranted. But, an intuitive explanation for the relationship between firm size and efficiency within a specific industry is based on economies of scale and organizational theory. The basic

implication of technological and organizational theories emphasizing transaction and agency costs of firm size is that within a specific industry (common production technology) and within a common institutional environment, firm size and efficiency may be linked through a trade-off of economies of scale and transactions costs and agency costs. Agency theory and transaction cost theory may help to explain why different sizes of firms exist at all. Given the existence of economies of scale, it could be expected that all co-operative activities would be conducted by large organizations. In situations where the benefits of small size are not sufficient to outweigh the benefits of economies of scale, large firms will predominate. In other cases, where agency and transaction costs are great or where economies of scale are not great, small size may be the optimum. In the case of fruit and vegetable-marketing co-operatives, transaction and agency costs of size may more than off-set the benefits from economies of scale for medium-sized co-operatives as compared to their smaller and larger counterparts. This is particularly possible if the organization's cost curve is concave from the above and if at the same time the vertical distance between the average costs of production and organizing costs is at its maximum for medium sized firms.

What is causing efficiency to decline with financial leverage? Further empirical research may illuminate the latent causes of this inverse relationship. One explanation may relate to the principal agent problems that monitoring, bonding, and adverse incentive costs may be incurred in a borrower-lender relationship in order to resolve problems of asymmetric information and misaligned incentives between the two parties (Jensen & Meckling, 1976). For example, the theory of incentive emphasizes the importance of regulatory rules on the level of effort that managers undertake in order to lower their costs of production. A related explanation for the inverse relationship between cost efficiency and financial leverage may be that sticking to co-operative principles has made it difficult for co-operatives to lower financing costs by raising relatively cheaper funds from public investors/ stock market. This conclusion has important implications for co-operative incentive structure reform. Obtaining sufficient equity capital is expected to improve co-operative efficiency. A substantial number of agribusiness marketing co-operatives could be more efficient by adjusting their capital structure.

## NOTES

1. The theoretical framework that leads to the hypothesis that some firms are more efficient than others is provided by the extensive literature on agency, incentives and contracts (Bogetoft, 2000; Lovel, 2001). For example, the theory of

incentives emphasizes the importance of regulatory rules on the level of effort that managers undertake in order to lower their costs of production.

2. Efficiency is generally defined relative to the best-practice observed in the industry, since the underlying technology is unknown.

3. In a standard stochastic frontier approach, inefficiency is measured relative to the estimated frontier, rather than the best-practice co-operative; that is, relative to a zero value for  $\hat{u}_{jt}$  which is not typically achieved by any of the co-operatives in the sample.

4. An alternative approach is to use a one-stage estimation. Wang and Schmidt (2002) argue strongly for one-step estimation whenever one is interested in the effects of firm characteristics on efficiency levels. However, given the complexity of the random parameters model, and a problem with model convergence, the two-stage approach was adopted here.

5. Boadway (1985) proposed the following formula to calculate the service cost of capital:  $r_k = q(i + \delta - r_q - \pi/1 - \pi) \cdot (1 - \phi) \cdot (1 - \tau\alpha/i + \alpha)$  where  $i$  is the opportunity cost of capital,  $\delta$  is the capital depreciation rate,  $r_q$  is the rate of growth in the acquisition of capital  $q$ ,  $\pi$  is the rate of inflation in the economy,  $\tau$  is the corporate income tax rate,  $\phi$  is the investment tax credit, and  $\alpha$  is the percentage capital cost allowance (CCA) rate (per cent).

6. Prior to estimations, condition indices are calculated to diagnose the presence and severity of collinearity. A condition index value between 10 and 30 indicates moderate to strong collinearity, and severe collinearity if it exceeds 30 (Besley, Kuh, & Welsch, 1980). In this study, collinearity does not appear to be an issue. The condition indices for fruit and vegetable, grain and dairy co-operatives are less than 10.

7. These percentages are calculated using the formula:  $(\sigma_u^2/\sigma_u^2 + \sigma_v^2) \times 100$ .

8. According to Coase (1937) as a firm grows larger its costs for achieving particular arrangements managerially tend to rise. The larger the firm, the more complex and hence expensive its management becomes, until further growth would make the cost of managing the newly internalized operations higher than the cost of transacting them on the market. Firms grow until conversion of further transaction costs into internal organizational costs ceases to represent a net saving.

9. Standard significance tests of structural parameters in random parameter models do not necessarily indicate the presence or absence of a 'significant' relationship among the model variables (Greene, 2004).

10. The agent's access to superior information allows him to extract information rents when a new production plan is established. He can claim that high costs are associated with the least reduced or most expanded activity.

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## REFERENCES

- Aigner, D. J., Lovell, C. A. K., & Schmidt, P. (1977). Formulation and estimation of stochastic frontier production function models. *Journal of Econometrics*, 6, 21–37.
- Akridge, J. T., & Hertel, T. W. (1992). Co-operative and investor-oriented firm efficiency: A multiproduct analysis. *Journal of Agricultural Cooperation*, 7, 1–24.
- Albaek, S., & Schultz, C. (1997). One cow, one vote? *Scandinavian Journal of Economics*, 99(4), 597–615.
- Ariyaratne, C. B., Featherstone, A., Langemeier, M. R., & Barton D. G. (1997a). An analysis of efficiency of midwestern agricultural co-operatives. Western Agricultural Economics Association, Selected Papers of the 1997 Annual Meeting, July 13–16, 1997, Reno/Sparks, Nevada.
- Ariyaratne, C. B., Featherstone, A. M., Langemeier, M. R., & Barton, D. G. (1997b). An analysis of efficiency of midwestern agricultural co-operatives. Web page [accessed 22 January 2005]. Available at [http://agecon.lib.umn.edu/cgi-bin/pdf\\_view.pl?paperid=276&ftype=pdf](http://agecon.lib.umn.edu/cgi-bin/pdf_view.pl?paperid=276&ftype=pdf).
- Ariyaratne, C. B., Featherstone, A. M., Langemeier, M. R., & Barton, D. G. (2000). Measuring X-efficiency and scale efficiency for a sample of agricultural co-operatives. *Agricultural and Resource Economics Review*, 29(2), 198–207.
- Battese, G. E., Rao, D. S. P., & O'Donnell, C. J. (2004). A metafrontier production function for estimation of technical efficiencies and technology gaps for firms operating under different technologies. *Journal of Productivity Analysis*, 21, 91–103.
- Battese, G., & Coelli, T. (1992). Frontier production functions, technical efficiency and panel data: With application to paddy farmers in India. *Journal of Productivity Analysis*, 3, 153–169.
- Besley, D. A., Kuh, E., & Welsch, R. E. (1980). *Regression diagnostics*. New York, NY: Wiley.
- Berry, D. M. (1994). Private ownership form and productive efficiency: Electric co-operatives versus investor-owned utilities. *Journal of Regulatory Economics*, 4(6), 399–420.
- Boadway, R. W. (1985). *The theory and measurement of effective tax rates. The impact of taxation on business activity*. Kingston, Ontario: Queen's University.
- Caputo, M. R., & Lynch, L. (1993). A nonparametric efficiency analysis of California cotton ginning co-operatives. *Journal of Agricultural and Resource Economics*, 18(2), 251–265.
- Caudill, S. B. (2003). Estimating a mixture of stochastic frontier regression models via the Em algorithm: A multiproduct cost function application. *Empirical Economics*, 28, 581–598.
- Chen, Ya-Chin (1997). *Dairy farm efficiency: Effects of co-operative membership*. Unpublished PhD Dissertation, The Pennsylvania State University.
- Christensen, L. R., Jorgenson, D. W., & Lau, L. J. (1973). Transcendental logarithmic production frontiers. *The Review of Economics and Statistics*, 55(1), 28–45.
- Coase, R. H. (1937). The nature of the firm. *Economica*, 4, 386–405.
- Co-operatives Secretariat. (2003). Co-operatives in Canada (2001 Data). Government of Canada, Ottawa.
- Craig, B., Pencavel, J., Farber, H., & Krueger, A. (1995). Participation and productivity: A comparison of worker cooperatives and conventional firms in the plywood industry. Brookings Papers on Economic Activity. Microeconomics, 121–174.

- Cranfield, J., Cousineau, L., Swidinsky, M., Lai, H., Goddard, E., & Rude, J. (1995). *Oligopoly power in the Canadian Food Processing Industry – further results*. Working Paper Series, WP95/02, University of Guelph, Guelph.
- Debreu, G. (1951). The coefficient of resource utilization. *Econometrica*, 19(3), 273–292.
- Enke, S. (1945). Consumer cooperatives and economic efficiency. *The American Economic Review*, 35(1), 148–155.
- Esho, N. (2001). The determinants of cost efficiency in co-operative financial institutions. Australian evidence. *Journal of Banking and Finance*, 25(5), 941–964.
- Färe, R., Grosskopf, S., & Lovell, C. A. K. (1985). *The measurement of efficiency of production*. Boston: Kluwer Academic Publishers.
- Farrell, M. J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society Series A*, 120(3), 253–290.
- Ferrier, G. D., & Porter, P. K. (1991). The productive efficiency of U.S. milk processing cooperatives. *Journal of Agricultural Economics*, 42, 161–173.
- Fulton, M., & Tang, Y. M. (1999). Testing the competitiveness of a multistage food marketing system: the Canadian chicken industry. *Canadian Journal of Agricultural Economics*, 47(3), 225–250.
- Greene, W. (2002a). *Alternative panel data estimators for stochastic frontier models. Current developments in productivity and efficiency measurements*. New York: New York University, Department of Economics.
- Greene, W. (2002b). *Fixed and random effects in stochastic frontier models*. Working Paper, Web page [accessed 15 September 2004]. Available at <http://pages.stern.nyu.edu/~wgreene/fixedandrandomeffects.pdf>.
- Greene, W. (2002c). *Econometric modeling guide: LIMDEP: Version 8.0*. Castle Hill: Econometric Software, Inc.
- Greene, W. (2004). Interpreting estimated parameters and measuring individual heterogeneity in random coefficient models. Web page [accessed 22 January 2005]. Available at <http://www.stern.nyu.edu/eco/wkpapers/workingpapers03/03-19Greene.pdf>.
- Grossman, S. J., & Hart, O. D. (1988). One share–one vote and the market for corporate control. *Journal of Financial Economics*, 20(1/2), 175–202.
- Huang, H-C. (2004). Estimation of technical inefficiencies with heterogeneous technologies. *Journal of Productivity Analysis*, 21, 277–296.
- Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *The American Economic Review*, 76(2), 323–329.
- Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs, and ownership structure. *Journal of Financial Economics*, 3(4), 305–360.
- Johnson, S. (1997). An empirical analysis of the determinants of corporate debt ownership structure. *Journal of Financial and Quantitative Analysis*, 32(1), 47–69.
- Jondrow, J., Lovell, C. A. K., Materov, I. S., & Schmidt, P. (1982). On estimation of technical inefficiency in the Stochastic Frontier production function model. *Journal of Econometrics*, 19, 233–238.
- Koopmans, T. C. (1951). An analysis of production as an efficient combination of activities: In Activity analysis of production and allocation. In: T. J. Koopmans (Ed.), *Cowles Commission for Research in Economics* (Monograph No. 13). New York: Wiley.
- Kumar, K. B., Rajan, R. G., & Zingales, L. (2002). What determines firm size? Web page [accessed 15 April 2005]. Available at <http://groups.haas.berkeley.edu/imio/zingales112102.pdf>.

- Kumbhakar, S., & Lovell, C. A. K. (2000). *Stochastic frontier analysis*. Cambridge, New York: Cambridge University Press.
- Lang, G., & Welzel, P. (1999). Mergers among German co-operative banks: A panel-based stochastic frontier analysis. *Small Business Economics*, 13(4), 273–286.
- Lopez, R. E. (1984). Measuring oligopoly power and production responses of Canadian food processing industry. *Journal of Agricultural Economics*, 35, 219–230.
- Meeusen, W., & van den Broeck, J. (1977). Efficiency estimation from Cobb-Douglas production functions with composed error. *International Econometric Reviews*, 18, 435–444.
- Michaelas, N., Chittenden, F., & Poutziouris, P. (1999). Financial policy and capital structure choice in U.K. SMEs: Empirical evidence from company panel data. *Small Business Economics*, 12, 113–130.
- Mosheim, R. (2002). Organizational type and efficiency in the Costa Rican coffee processing sector. *Journal of Comparative Economics*, 30(2), 296–316.
- Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics*, 4, 147–175.
- Nasr, R. E., Barry, P. J., & Ellinger, P. N. (1998). Financial structure and efficiency of grain farms. *Agricultural Finance Review*, 58(3), 33–48.
- Orea, L., & Kumbhakar, S. C. (2004). Efficiency measurement using a latent class stochastic frontier model. *Empirical Economics*, 29, 169–183.
- Qian, X. (2004). *Impacts of world trade policies on the Canadian poultry market*. Unpublished Master's thesis, Department of Rural Economy, University of Alberta, Edmonton.
- Rajan, R., & Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. *Journal of Finance*, 50, 1421–1460.
- Sexton, R. J., & Iskow, J. (1993). What do we know about the economic efficiency of co-operatives: An evaluative survey? *Journal of Agricultural Cooperation*, 8, 15–27.
- Shephard, R. W. (1953). *Cost and production functions*. Princeton: Princeton University Press.
- Singh, S., Coelli, T., & Fleming, E. (2001). Performance of dairy plants in the co-operative and private sectors in India. *Annals of Public and Co-operative Economics*, 72(4), 453–479.
- Solow, R. M. (1957). Technical change and the aggregate production function. *Review of Economics and Statistics*, 39(3), 312–320.
- Stutzman, J. R., & Stansell, S. R. (1992). An examination of the relative economic efficiency of commercial vs. co-operative telephone companies. *Journal of Economics and Finance*, 16(2), 47–68.
- Train, K. (2002). *Discrete choice: Methods with simulation*. Cambridge: Cambridge University Press.
- Tsionas, M. (2002). Stochastic frontier models with random coefficients. *Journal of Applied Econometrics*, 17, 127–147.
- Williamson, O. (1985). *The economic institutions of capitalism*. New York: The Free Press.
- Zou, L. (1992). Ownership structure and efficiency: An incentive mechanism approach. *Journal of Comparative Economics*, 16(3), 399–431.

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# INTRODUCING DIFFERENTIAL WAGE RATES IN THE KIBBUTZ ECONOMY: IS IT THE END OF THE KIBBUTZ? THEORY AND NEW DATA

Ehud Satt

## ABSTRACT

*In this work we analyze the effect of the recent trend of introducing differential wages in the Kibbutz economy. Note that this process is growing at a fast pace. Within less than a decade, the differential wages have become the prevailing model in the Kibbutz economy.*

*Using the LMF theoretical model, we analyze the economic effects of that change. We find that in the short run, this process may bring stability to the Kibbutz. However, in the long run, the contrary is true. Combined with hired (outside) labor, this process will change the Kibbutz, turning it into a regular competitive firm (CMF). In this way “the final-curtain hypothesis” of the Kibbutz will come into effect. The Kibbutz, as a socio-economic phenomenon, will disintegrate about a century since its establishment.*

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## 1. INTRODUCTION

The aim of this paper is to examine the effect of the introduction of differential wages on the Kibbutz economy. Such an examination is important, since many regard the institution of differential wages as an ideological, social, and economic watershed between the continued existence of the Kibbutz and its disintegration. In this article we concentrate on the economic aspects of the question.

The “Differential Wage Model” plays a central role in the general “change process” that the Kibbutzim (plural of Kibbutz) have been recently undergoing – especially since the deep economic crisis of the mid-80s. Its main objective is to bring greater *economic efficiency* to the Kibbutz. Accordingly, the argument for instituting differential wages is that, by motivating individual members to invest greater efforts and pursue jobs assuring higher returns – in the same manner as in the open labor market – it will improve resource allocation. This is in contrast to the situation in the traditional Kibbutz, where the “wages” are uniform and equal for all Kibbutz members, regardless of the effort invested or managerial function undertaken. However, note that this model contradicts the basic ideological foundation of the traditional Kibbutz – the *Equal Distribution of Income* principle.

*The theoretical analysis* in this paper is based on the LMF (Labor-Managed Firm) or the PC (Producer Cooperative) model. It continues our earlier studies that used this model to analyze other aspects of the “change process” (Satt, 1991; Satt & Ginzburg, 1992, 1998; Satt & Sheaffer, 1994; Satt, 1996).

As we will see, in this case the formal theoretical results show that the economic behavior of the Kibbutz in the short run lies between that of the traditional Kibbutz and those of a competitive firm. In the long run, however, instituting differential wages may lead to overall disintegration of the Kibbutz (LMF), transforming it fully into a capitalist competitive firm (CMF – Capital-Managed Firm, sometimes called also PMF – Profit-Maximizing Firm).

This paper may also be viewed as a complementary continuation of two previous papers. The first (Satt, 1991) dealt with the issue of differential wages in the Kibbutz, but did so only *indirectly* – by considering the effect of eliminating the basic “Equality of the Value of Labor” characteristics of the traditional Kibbutz (see Section 3, below). The second paper (Satt & Ginzburg, 1998) addressed the issue in terms of the effects of “hiring out” Kibbutz members.

Note that it is primarily the “white-collar,” highly skilled Kibbutz members – whose alternative wage earned outside the Kibbutz is higher than the (equal) “wage” within the Kibbutz – who support the demand for “differential wages.” As the professional and managerial backbone of the Kibbutz, they sometimes even threaten to leave the Kibbutz if that change is not instituted (Satt & Ginzburg, 1998).

That paper proceeded from the assumption that their demand was not being accepted. We showed there that in such a case there could be two alternative outcomes:

1. *The High Path* in which those members remain faithful to the egalitarian principles of the Kibbutz. In this case, the economic and social position of the Kibbutz improves as compared with its original position.
2. *The Low Path* in which those members decide to leave the Kibbutz. As a result the Kibbutz undergoes a process of economic and social deterioration including a brain drain of “white-collar” workers. In this instance, the economic and social position of the Kibbutz worsens as compared to its original position.

Our present paper concludes the analysis. We assume here that in the final analysis the Kibbutz does succumb to economic and social pressure exerted by its “white-collar” members and does, in fact, accept their demand by switching to the “Differential Wage Model.” This scenario is also a more accurate description of the actual development in the Kibbutz recently (see Section 2). This time, then, our analysis *directly examines* the implications of this far-reaching move on the Kibbutz economy.

The paper is structured as follows. In the next section we present data on the recent development of the Differential Wage Model in the Kibbutzim. The data indicate that this phenomenon – completely non-existent in Kibbutzim until the mid-90s – is now predominant in the Kibbutz Movement. These data provide the basis for the rough *final curtain hypothesis*, maintaining that in a few years time, the “Differential Wage Model” could achieve full control over the Kibbutz Movement. In the rest of the paper we analyze the *economic implications* of this transformation. Section 3 presents a theoretical analysis of differential wages in the Kibbutz economy, based on the LMF model, and sets up the economic modus operandi of the Kibbutz with differential wages in the short run. Section 4 discusses the long-term implications of this step. We show that together with the possibility of hired (outside) labor, the Differential Wage Model could lead to a

complete disintegration of the Kibbutz economy, transforming it into a competitive capitalist firm. This claim may be viewed as a kind of “impossibility theorem” for the existence of the Kibbutz with “differential wages.” Finally, Section 5 summarizes the discussion.

## **2. THE TRANSITION TO THE DIFFERENTIAL WAGE MODEL: KIBBUTZ DATA DESCRIPTIVE STATISTICS AND RESEARCH HYPOTHESES**

### *2.1. Preliminary Remarks*

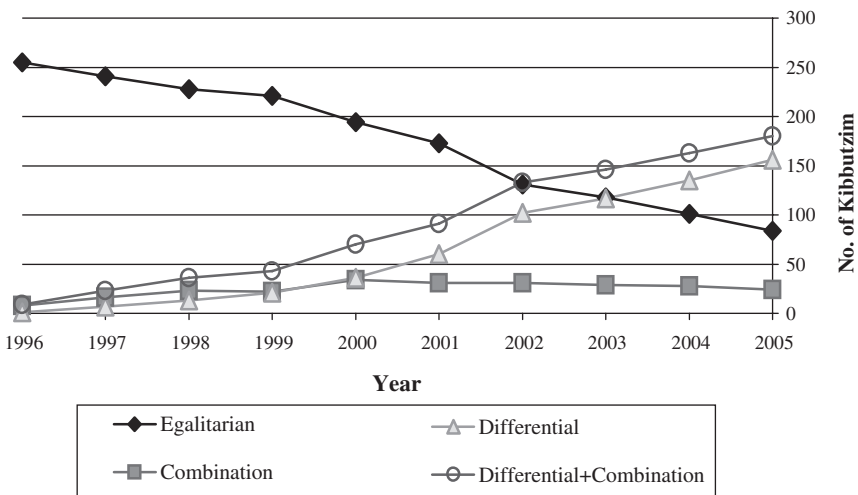
Before we continue to describe the process of transition to the Differential Wage Model in the Kibbutz, a few remarks are in order. Firstly, the following data, and their related descriptive statistics (Table 1 and Fig. 1), are based on raw material provided by Dr. Shlomo Getz of the “Kibbutz Research Institute” at Haifa University. Thanks are due to Getz, who for years has diligently collected and collated data on the “change process” in Kibbutzim, and also to the Kibbutz Research Institute, for readily and generously forwarding us the relevant material (Getz, 1998–2003, and also up-to-date electronic data). Secondly, this material is based on detailed data of 264 Kibbutzim which form the overall stable set of Kibbutzim in the Kibbutz Movement.<sup>1</sup> Note that the Kibbutzim were affiliated to smaller (“daughter”) Kibbutz movements: the *Takam* or the United Kibbutz Movement, the *Kibbutz Artzi* (National) Movement, and the *Kibbutz Dati* (Religious) Movement. The *Takam* and *Kibbutz Artzi* are now in a process of unification. The united organization is called *Takatz*, meaning – The Kibbutz Movement. The present paper does not distinguish between these specific Kibbutz affiliations.

A sample of general demographic and economic data on the Kibbutz Movement today is given in Appendix C.

Finally, the data in the original survey are not always complete, and may be deficient in respect of some Kibbutzim, especially regarding the first years (1996–2000). In such instances we have assumed that the Kibbutzim continue to behave according to their earlier model, unless otherwise stated. Hence, if our data are biased (see Table 1 and Fig. 1) in respect of the development of the “Differential Wage Model,” they are *biased downward*. A number of Kibbutzim may have switched to this model even earlier.

**Table 1.** The Kibbutz Data (Number of Kibbutzim in the Different Models).

Model	Year										
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	
Egalitarian	255	241	228	221	194	173	131	118	101	84	
Combination	8	16	23	22	34	31	31	29	28	24	
Differential	1	7	13	21	36	60	102	117	135	156	
Differential+combination	9	23	36	43	70	91	133	146	163	180	



*Fig. 1.* The Kibbutz Data (Number of Kibbutzim in the Different Models). *Source:* Adapted from Getz (1998–2003 and electronical data).

2.2. Review of the Data and the Rough “Final Curtain Hypothesis”

The review of Kibbutz data from the past decade seems really to be a case of *one picture being worth a thousand words* (see Table 1 and Fig. 1). Over a mere ten-year period (1996–2005), a phenomenon previously either completely non-existent or close to negligible in the Kibbutz Movement became a *leading and predominant trend*.

As we can see in Table 1 and Fig. 1, in 1996 at the beginning of the period, of the 264 Kibbutzim, just one had instituted “differential wages,” while 255 Kibbutzim kept faith with the principles of egalitarianism and cooperation.

By 2005, the picture had changed dramatically. The Kibbutzim that adopted the Differential Wage Model *strongly outnumbered* those keeping faith with the traditional Kibbutz. Whereas only 84 Kibbutzim, less than one-third (32%), continued to uphold the traditional Kibbutz principle of “Equal Distribution of Income,” 156 Kibbutzim chose to abandon it in favor of “differential wage” patterns (59%). If we add to that the 24 Kibbutzim that adopted the interim Combination Model (for more details, see below), we obtain a total of 180 Kibbutzim – more than two-thirds (68%) of all Kibbutzim – undergoing a process of change!

As regards the future, in light of these basic data alone a far-reaching *final curtain hypothesis* is possible: if this strong and consistent trend continues, and if the Differential Wage Model does contradict the Kibbutz way of life, then within another decade or so, the Kibbutz as an ideological and social phenomenon may cease to exist.

None of our previous studies analyzing the Kibbutz economy and the “change process” (especially the introduction of “hired labor” and members’ “hiring out”) seemed to point to such a clear and powerful process as the switch to “differential wages.”<sup>2</sup> This process is liable to bring about the termination and dissolution of the Kibbutz Movement. Perhaps within a mere two decades, the Kibbutz Movement, now almost 100 years old,<sup>3</sup> and which played a vital role in establishing and settling the State of Israel, may disintegrate and cease to exist as an ideological and social phenomenon.

The outer shell of name and organizational framework could persist for a while,<sup>4</sup> but gradually the Kibbutz will lose its egalitarian and cooperative spirit, until the shell itself dries out and drops off, signifying the end of the Kibbutz Movement.

### 2.3. “Income Distribution” Models in the Kibbutz Economy

There are currently three principal “income distribution” models, with minor variations, in the Kibbutz Movement (see [Table 1](#) and [Fig. 1](#)).

#### 2.3.1. The Traditional Egalitarian Cooperative Model

Ideologically, this model (referred to in the [Table 1](#) and [Fig. 1](#) as “Egalitarian”) is based on the well-known Marxist principle of “from each according to his ability; to each according to his need.” In practice, this mainly takes the form of the “Equal Distribution of Income” principle, while in special instances (health, education, etc.) distribution is effected by need. The guiding principle here is the total absence of connection between “Reward” and “Contribution”

by the member, or for that matter, between “Work” and “Personal Subsistence Budget” (“wage”). Exactly these principles are challenged by the Differential Wage Model.

One may argue, on behalf of the “Egalitarian Cooperative Model,” that it most closely approximates the *social justice* ideal (Satt, 1996).<sup>5</sup> However, a strong argument against it is that it is detrimental to *economic efficiency*, since it provides no economic motivation for investing any effort toward economic development and success on a personal level. Beyond ideological motivation and social pressure, Kibbutz members receive their equal share of income, whether or not they invest any effort and assume tasks involving responsibility and managerial burden. This is a key argument in favor of instituting the Differential Wage Model that is supposed to rationalize the economic system and resource allocation in the Kibbutz.

### 2.3.2. The Combination Model and Its Puzzle

In terms of chronology and methodology, this is the first model to have been introduced into the Kibbutz economy in reaction to the “Egalitarian Cooperative Model.” As its name implies, it is an *interim model* – between the traditional and the “Differential Wage Model.”

Under this model, income distribution remains egalitarian for the most part, but a relatively small portion of the Kibbutz members’ income is based on their wage in the (alternative) external labor market. It is generally accepted that the external non-egalitarian portion, constitutes some 20% of the member’s total income. Accordingly, this model is sometimes called the “80 [Egalitarian] – 20 [Differential] Model” (Rosner, Palgi, & Goldemberg, 2002).

A short glance at Table 1 and Fig. 1 shows that this model has not evolved over time. In 1996, eight Kibbutzim adopted it, peaking at 34 Kibbutzim in 2000, and decreasing to a level of 24 Kibbutzim (less than 10% of all Kibbutzim) in 2005.

The puzzle, then, is what explains the consistently low level of this model, despite the presumed expectation that it would combine the benefits of both other polar models?

A more thorough scrutiny of the raw data shows two patterns of Kibbutzim adopting this model:

1. In most cases – about two-thirds of Kibbutzim adopting this model – it is only an *interim stage* on the road leading toward the “Differential Wage Model.” Those Kibbutzim remain at this interim stage for two to five years only, and then continue to the final “Differential Wage Model.”
2. A smaller portion (about one-third) of Kibbutzim choosing the Combination Model, began implementing it relatively early and has continued

with it throughout. Explanations for this phenomenon of ongoing adherence to the Combination Model can be found in several hypotheses:

- Firstly, that from the outset they were not subject to the severe economic and social pressures that led other Kibbutzim to shift to the Differential Wage Model (see discussion in Section 2.4).
- Secondly – that the Combination Model did in fact solve the economic and social problems of those Kibbutzim at an early stage. Thus they saw no need to continue to the more radical “Differential Wage Model.”
- Thirdly – that it is simply taking them more time (perhaps seven to ten years) until they resolve the difference of opinions among their members, and opt for the final Differential Wage Model.

These and other hypotheses should be examined in a further study. However, it is worth noting that we do not know of even one case of a Kibbutz adopting the Combination Model that returned to the “Egalitarian Cooperative Model.”

### 2.3.3. *The Differential Wage Model*

It is this model and its implications, which contrast with the Egalitarian Cooperative Model, which the present paper addresses.

Faced with the dilemma of choosing between social justice and economic efficiency, the Differential Wage Model primarily emphasizes *efficiency*, largely at the cost of *social justice*.

Getz (2000) defines this model as follows:

The Differential Wage Model – in which all income from work, and sometimes also from other sources, net of various taxes, replaces the member’s budget. Most, although not all, those Kibbutzim have a “Safety Net” of mutual aid, which has lent this method its name [in the Kibbutz parlance].

In other words, where this model is in place, members working outside the Kibbutz (“outside workers”) receive their pay from their outside earnings, while those working in the Kibbutz itself (“inside workers”) receive an “alternative wage” applicable to their occupation in the outside labor market. In any case, market prices (wages) form the basis for their income.<sup>6</sup>

However, above and beyond outside income tax, internal taxes (“community taxes”) are usually deducted from members’ income to finance the “Safety Net.” These “community taxes” are generally proportionate or even progressive in relation to the members’ outside income. A usually uniform “municipal tax” is also deducted. For the purpose of this discussion, we may assume that under this model some 20% of members’ “outside income” goes

to internal taxes. Thus, in line with the Combination Model (see above), it may be designated as the “20 [Egalitarian] – 80 [Differential] Model.”

This model is known as the “Safety Net” in Kibbutz parlance, mostly due to political correctness. It expresses the aspiration that the model should preserve some basic solidarity and not wholly abandon the weaker and unluckier members of the Kibbutz. Whether this “Safety Net” will actually continue to exist in the future, or will gradually disappear, is an open question that must face the test of reality.

A second look at Table 1 and Fig. 1 reveals a strong and persistent increase in the number of Kibbutzim that made the transition to the Differential Wage Model during the period. On average, more than 17 Kibbutzim (155/9) have made the shift annually; 2002 was a record year, in which more than 40 Kibbutzim switched to that model.

To summarize this point, a general observation of the data shows that the Differential Wage Model, starting virtually from scratch in 1996, took no more than 8 years (until 2003) to catch up with the Egalitarian Cooperative Model of the Kibbutz, which held sway almost exclusively in Kibbutzim until the mid-90s. Since then, the Differential Wage Model has been the predominant and leading model in the Kibbutz Movement and it is still going strong.

#### *2.4. What Motivates Kibbutzim to Opt for the Differential Wage Model? A General Discussion*

Kibbutzim are likely to abandon the Egalitarian Cooperative Model in favor of the Differential Wage Model for two main reasons, one economic and the other social.

1. *Economic pressure* is exerted through the aspiration to greater efficiency. The worse the economic situation of the Kibbutz, the greater is the pressure to streamline, even at the cost of abandoning social justice. This was why the severe economic crisis of the mid-80s served as a trigger for processes of change. Moreover, when a ship starts sinking, passengers jettison all excess burdens, even if they possess nostalgic or ideological value. Thus, in crisis situations, people are sometimes willing to abandon solidarity and mutual aid arrangements, as each individual fights for his own life.
2. *The social explanation* is related to the universal process that intensifies over time, toward *greater individualism*. “Self-realization” replaces the former “national and movement missions” (Satt, 1994). Hence, the call



for privatization in all walks of life – work, consumption and even production – becomes increasingly strident.

Each of these two causes – the economic or the social – can, of itself, impel the Kibbutz toward the “Differential Wage Model.” But when they combine – as they usually do, because the economic situation affects the social – they become a high-powered force.

This basic analysis may indicate that only a limited number of Kibbutzim, blessed with both economic strength and social cohesion, can resist the mounting trend toward the introduction of the Differential Wage Model. And it is doubtful whether even these, if they remain isolated, can withstand the powerful current of the “Differential Wage Model.”

These general considerations, based as they are solely on descriptive statistics, require more in-depth examination. It seems important that further comprehensive econometric and sociological studies be conducted on these topics. They should examine – inter alia – the effect of additional variables such as movement affiliation, size of the Kibbutz, when the Kibbutz was founded, its location, and so on.

At this point, it is worth noting that looking with a naked eye at the raw data, it is difficult to distinguish and isolate any dominant factor causing the transformation into the Differential Wage Model. If at all, it is the economic variable. Poor Kibbutzim make the move earlier; affluent ones apparently allow themselves to “buy” time or to “pay the economic price” necessary to maintain the Kibbutz ideological and social principles.

Interesting and more detailed work on this issue is already underway (see for example: [Rosner & Getz, 1996](#); [Rosner et al., 2002](#); [Pavin, 2003](#); [Rosner, 2003](#); [Rosner et al., 2004](#)). These studies may cast additional light on that phenomenon.

### **3. THE DIFFERENTIAL WAGE MODEL: A THEORETICAL ANALYSIS**

#### *3.1. The “Ideal Model” of the Kibbutz*

##### *3.1.1. The Basic State of the Ideal Model of the Kibbutz and its “Equality of the Value of Labor” Characteristic*

In our context, the term “ideal model” has a dual meaning. On the one hand, its results represent an optimal state; on the other, it is based on strong assumptions that are not always fulfilled in reality.

The adaptation of the Labor-Managed Firm (LMF) model to the Kibbutz economy is based on five basic assumptions.<sup>7</sup>

- A.1. *Heterogeneous labor force:* The Kibbutz employs various professions and skills, not an amorphous, homogenous type of labor. Note that this is not a technical assumption, made in order to bring the model closer to reality, but it is crucial to the analysis. Without it, there is no meaning to the effects of the “change process” on the distribution of income in the Kibbutz.
- A.2. *Equal distribution of income principle:* The Kibbutz is an egalitarian institution: its income is distributed equally among all members, irrespective of their profession or skills.  
This assumption is relaxed in the following analysis.
- A.3. *Self-labor and self-employment principles:* Only members work in the Kibbutz, and all members work in the Kibbutz itself. This assumption is also relaxed in the next section.
- A.4. *Maximization of income per member:* The economic goal of the Kibbutz is to maximize income per member.
- A.5. *Labor mobility:* This is a long-run model, in the sense that in the long run, the Kibbutz may adjust the number of its members and the composition of their professions and skills, as necessary to attain its economic goal.

Note that Assumptions A.2 and A.3, which are ideological in nature, are representative of what used to be the unique Kibbutz way of life. In earlier studies (Satt & Ginzburg, 1992, 1998; Satt & Sheaffer, 1994) we looked at the effects of the “change process” on Assumption A.3 – labor autarchy of the Kibbutz economy. This time we are interested in the effects of the change on Assumption A.2 – the income distribution.

Using the traditional LMF model, and Assumptions A.1–A.5, Satt (1991, 1996) has shown that at the optimum, the Kibbutz will consist of members with different types and skills, such that the value of the marginal product of all types of labor will be equal. This basic characteristic is called the *Equality of the Value of Labor*.

To illustrate this result suppose, for simplicity and without loss of generality, that there are only two types of labor: semi-skilled non-professional (“blue-collar”), and highly skilled, managerial and professional (“white-collar”). Denote the number of “blue-collar” and “white-collar” members as  $n_1$  and  $n_2$  respectively (for a complete list of symbols, see Appendix A). Then, according to the result of the “Ideal Model,” at the optimum, the value of the marginal product of “blue-collar” workers,  $pf_{n_1}$  will be equal to

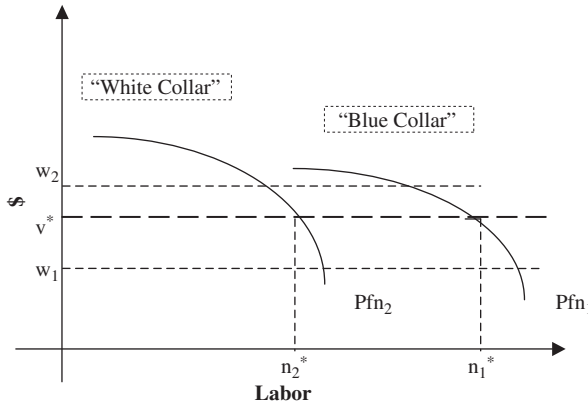


Fig. 2. The “Ideal Model” of the Kibbutz.

the value of the marginal product of “white-collar” workers,  $pf_{n_2}$ . Furthermore, in keeping with the traditional LMF model, they will also be equal to the optimal income per member  $v^*$ . That is,

$$Pfn_1 = Pfn_2 = v^* \tag{1}$$

This result is illustrated in Fig. 2, which enables us to compare the optimal conditions for all types of labor.<sup>8</sup>

In Fig. 2,  $v^*$  represents maximum income per member in the Kibbutz basic (“Ideal”) state. In this case, the optimal employments of “white-collar” and “blue-collar” workers are  $n_2^*$  and  $n_1^*$  respectively, such that  $pf_{n_1} = pf_{n_2}$ , as in Eq. (1). The (exogenous) external wage rate of the “blue-collar” workers is given by  $w_1$  and that of the “white-collar” workers by  $w_2$ .

The importance of the “Equality of the Value of Labor” in the Kibbutz economy should not be underestimated. This result constitutes the basis of economic and social democracy in the Kibbutz (Satt, 1991). In the present paper we will think of the “Ideal Model” as the “pure” beginning step of the “Egalitarian Cooperative Model.”

### 3.2. The Institution of the Differential Wage Model

The “Equality of the Value of Labor” characteristic (Eq. 1), and its link with the “Equal Distribution of Income” principle, is rendered possible in

an ideal world, where there is no external labor market to serve as an economic alternative for the Kibbutz members, or when the Kibbutz members – out of social considerations – ignore that alternative.

In practice – in the *real world* – as the economic situation of the Kibbutzim deteriorates and their internal cohesion weakens, individualistic considerations intensify in tandem, until the “Ideal Model” no longer reflects reality.

“White-collar” Kibbutz members look at the higher pay their colleagues on the outside are earning, and call for the Kibbutz to institute differential wages as a condition for their remaining there. The moment this demand is accepted, in a move implying the privatization of labor, the “change process” gets underway. The process also usually involves far-reaching privatization in the field of consumption and sometimes in production too, which is not directly dealt with in this paper.

We now will turn to examine the effect of the “change” on the production system in the Kibbutz economy.

Assume a neo-classical production function of the type  $f(\cdot)$

$$y = f(n_1, n_2, K) \quad (2)$$

where  $y$  is the aggregate product of the Kibbutz,  $n_1$  (as before) is the number of semi-skilled (“blue-collar”) workers, and  $n_2$  is the number of highly skilled (“white-collar”) workers.

The total number of Kibbutz members is  $N$ , where  $N = n_1 + n_2$ , and  $K$  is the value of capital in the Kibbutz.

The objective function of the Kibbutz with “differential wage,” will be this time

$$\text{Max}_{(n_1, n_2, K)} z = \frac{Pf(n_1, n_2, K) - (w_1 n_1 + w_2 n_2) - rK - F}{N} \quad (3)$$

where  $w_1$  and  $w_2$  are the alternative wages in the labor market of  $n_1$  (the “blue-collar” workers) and  $n_2$  (“white-collar” workers), respectively. Thus  $(w_1 n_1 + w_2 n_2)$  are the Kibbutz’s total (differential) “payroll payments” to its members.  $r$  is the alternative cost of capital, and therefore  $rK$  are the “capital expenses” (“interest payments”) of the Kibbutz.  $F$  is the fixed cost of the Kibbutz, and  $P$  is the market price of the output.

In general we assume here that the Kibbutz maximizes the (equal) “remainder of income per member,”  $z$ , after the payment of the differential wages and the costs of other external inputs.

Note that  $z$ , the “remainder of income per member,” differs from  $v$  – the (full) “income per member,” in the “Ideal Model.” This is since the “differential wage” – payroll payments ( $w_1n_1+w_2n_2$ ) of the Kibbutz members – have been deducted from  $v$ .

Assuming an interior solution, the necessary conditions for this maximum are

$$Pfn_1 = w_1 + z^* \tag{4}$$

$$Pfn_2 = w_2 + z^* \tag{5}$$

and

$$Pfn_K = r \tag{6}$$

where  $Pfn_1$ ,  $Pfn_2$  and  $Pfn_K$  are the values of marginal product of the semi-skilled worker, the skilled worker, and capital, respectively.  $z^*$  is the “remainder of income per member” at the maximum.

These necessary conditions for the maximum, dictate the production characteristics, or the *modus operandi* in the short run of the Kibbutz that has adopted the Differential Wage Model (see Fig. 3).

We shall first address the formal aspects of this result, comparing them to the parallel conditions of the Kibbutz in the “Ideal Model” and to those of the capitalist competitive firm. The necessary conditions for the allocation

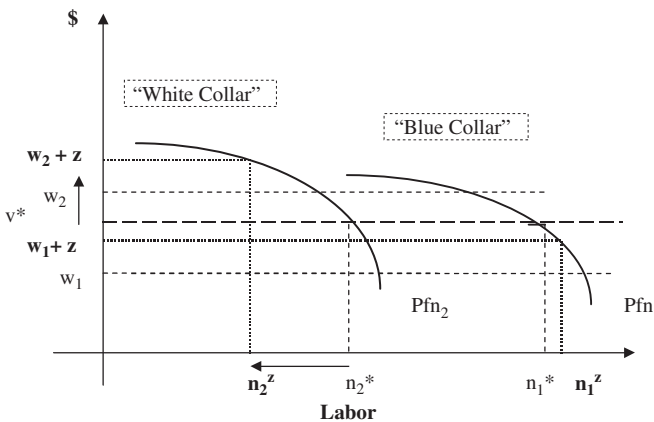


Fig. 3. Kibbutz with “Differential Wages”.

of capital, Eq. (6) – are common to all cases, and we therefore deal only with those conditions dictating the allocation of labor – Eqs. (4) and (5).

In the “Ideal Model” of the Kibbutz, the necessary conditions for maximum income per member,  $v^*$ , are (Satt, 1996)

$$Pfn_1 = v^* \tag{7}$$

and

$$Pfn_2 = v^* \tag{8}$$

Since both values of marginal product of labor – of the two types – are equal to  $v^*$ , we obtain the “Equality of the Value of Labor” result in Eq. (1).

In a competitive firm, the necessary conditions for maximum profit are clearly different. They are

$$Pfn_1 = w_1 \tag{9}$$

and

$$Pfn_2 = w_2 \tag{10}$$

which is to say that the values of marginal product of labor are equal to labor prices (wages) in the market.

Accordingly, conditions (4) and (5) may be viewed as a combination of conditions (7) and (8) with conditions (9) and (10), or as the combining of the “Ideal Model” with a competitive firm. At the optimum, the value of marginal product of labor of any kind in a Kibbutz with “differential wages,” is equal to market wage  $w_i$  ( $i = 1, 2$ ), plus the “remainder of income per member,”  $z^*$  (where  $z^*$  is lower, therefore, than  $v^*$ ).

Further considerations will show the economic meanings of Conditions (4) and (5). In a “Differential Wage” Kibbutz, the overall “cost of labor” of a member to the Kibbutz, consists of two components:

- a. Direct wage (at market prices) paid to the member,  $w_i$ .
- b. The equal share of the “remainder of income per member,”  $z$ .

Hence the necessary condition for the maximum is the equalization of the members’ value of marginal product ( $Pfn_i$ ), with their overall “cost of labor” components ( $w_i + z$ ).

This analysis proves the following proposition:

**Proposition 1.** The Differential Wage Model of the Kibbutz in the short run.

In the short run, the introduction of the Differential Wage Model in the Kibbutz economy creates a situation in the production system which is a combination of the Kibbutz and a competitive firm. The necessary conditions for maximum of the “remainder of income per member” in this case, are Eqs. (4)–(6) above.

Fig. 3, which is a continuation of Fig. 2 of the “Ideal Model” of the Kibbutz, describes the process of transition to differential wages in the initial stage.

With the institution of differential wages in the Kibbutz, according to conditions (4) and (5), the employment of the highly skilled (“white-collar”) members will then decrease from the Kibbutz “Ideal Model” level,  $n_2^*$  to a level of  $n_2^z$ , which is even lower than the level of the competitive firm.

On the other hand, the employment of semi-skilled (“blue-collar”) members will as if “first” decrease from the “Ideal Model” level of  $n_1^*$ , to that of the competitive firm, but will then increase to its final place at a level of  $n_1^z$ .

In both cases, the value of marginal product,  $pf n_i$ , is equal to the wage level,  $w_i$ , plus the “remainder of income per member,”  $z$ . In general, we do not know whether the Kibbutz will increase or decrease its product as a result of introducing “differential wages.”

Another effect, which we do not address here and which might result from the introduction of the Differential Wage Model, is the increase of labor productivity. This is one of the objects of the “change process.” Its effect, which might be reflected as an upward shift of the value of marginal product curves, is not reflected in Fig. 3 for simplicity of the exposition. In any case, it will not affect the following analysis and conclusions.

### 3.3. *An Extension: A General Formulation of the Models of “Change”*

We will now resume our analysis of the “change process.” We may think of a general case of the “change process” (regarding income–distribution) by a continued sequence of models between the “Ideal Model” of the Kibbutz, and the “Differential Wage Model.” This can be done by using the parameter  $\alpha$  to denote the rate of the member’s income out of the “differential wage.”

Note that  $\alpha$  is, in effect, the duality (or complementary) parameter of the *community tax*. In other words, denote the rate of the “community tax” on the external differential wages as  $\tau$ , then  $\alpha = 1 - \tau$ .

Thus:

- If  $\alpha = 0$ , we are clearly in the situation of the “Ideal Model” of the Kibbutz. In this case there is no connection between members’ (private) income and their (alternative) wage rates.
- If  $\alpha = 1$ , there exists a full Differential Wage Model situation, without “Safety Net.” In this case there is full connection between members’ income and their (alternative) wage rates.
- If  $0 < \alpha < 1$ , we have differential wages with a “Safety Net.”<sup>9</sup>

Thus, for example, where  $\alpha = 0.2$ , we obtain the “Combination Model,” mentioned in the previous section, and where  $\alpha = 0.8$ , we obtain the “Differential Wage Model,” with “Safety Net” at a rate of 20% of the “differential wage.”

For a numerical example of sequence of “differential wage” models, see Appendix B.

We can now state this general formulation as a Corollary to Proposition 1, above.

**Corollary to Proposition 1.** The general case – a continuous sequence of models of transition to the Differential Wage Model in the Kibbutz.

We may formulate the general case of the “change process” (regarding income distribution) by continues sequence of models between the “Ideal Model” of the Kibbutz, and the “Differential Wage Model.” Using the parameter  $\alpha$  to denote the rate of the member’s income out of the “differential wage,” and by proper adaptation of the objective function, (3), the necessary conditions for the maximum in this case (parallel to Conditions (4) and (5)) are

$$Pfn_1 = \alpha w_1 + z^* \tag{11}$$

and

$$Pfn_1 = \alpha w_2 + z^* \tag{12}$$

Two interesting questions may be raised in this context:

1. Does any optimal  $\alpha$  actually exist, that will optimally balance the social justice components of the “Ideal Model” with the economic efficiency of a competitive firm (see the discussion of the Combination Model above)?
2. Is this  $\alpha$  stable?



We do not have complete answers to these questions. However, a careful consideration of the data relating to Kibbutzim indicates that parameter  $\alpha$  tends to go the whole way. Most of the Kibbutzim that arrive at the Combination Model ( $\alpha = 0.2$ ), gradually proceed to the Differential Wage Model with a “Safety Net” ( $\alpha = 0.8$ ), and sometimes even without it ( $\alpha = 1$ ).

In any event, the size of  $z$  – the remainder of income per member, after payment of the “differential wage” – will vary for every  $\alpha$ . In the next section, we will elaborate more on component  $z$ , which distinguishes the Differential Wage Model Kibbutz from the competitive firm.

#### **4. THE LONG RUN IMPLICATIONS: THE (NON-) VIABILITY OF THE KIBBUTZ WITH “DIFFERENTIAL WAGES”**

As we have seen, two characteristics distinguish the Kibbutz with differential wages from a competitive firm (CMF): one is the internal “community taxation,” which is related to the parameter  $\alpha$  (actually,  $1-\alpha$ ). The other is the factor  $z$  – the “remainder of income per member,” that Kibbutz members receive in addition to the “differential wage.”

The (internal) “community taxation” – on which we elaborated at length in the previous section – may be thought of as a “*social cost*” that Kibbutz members are willing to pay for a “Safety Net,” in order to preserve some of the solidarity and mutual aid to the weak. This may be also considered as the cost of maintaining the “*social capital*” developed during the egalitarian Kibbutz era (the “Ideal Model”). It will be interesting to follow up and see whether, and to what extent, that “Safety Net” remains in place, once the personal and social relationships of the Kibbutz members fade and vanish over time. For the following analysis we assume that the level of the “community taxation” is very low, that is,  $\alpha$  is close to one.

The other characteristic is the effect of factor  $z$ , the “remainder of income per member.” We will address this issue now.

Before going on to analyze the long run effects of  $z$ , we need to distinguish between two basic possibilities:

In general,  $z$  can be either positive or negative i.e., the Kibbutz may have a *profit* after the payment of the “differential wage” (and other external inputs), or it may record a *loss*.

We will look, first, at the second case, that of a negative “remainder of income per member” ( $z < 0$ ).

In this case – which today characterizes a large proportion of Kibbutzim that are in economic straits – there will be no “profit sharing.” On the contrary, members may actually be called upon to participate in the payment of losses. If that happens, the members have no economic interest in continuing their membership in the Kibbutz. Assuming that they can obtain their alternative wage,  $w_i$ , outside the Kibbutz, they will prefer to leave the Kibbutz. We are seeing this development today in many Kibbutzim that are suffering from a severe negative demographic balance, as a result of the outward “migration” of young members who have an alternative outside. Only the old and weak remain in the Kibbutz, or what is left of it. In any case, in the long run, a Kibbutz remaining in a loss after “differential wage” payments will disintegrate and disappear.

We now turn to the second possibility, in which the Kibbutz is “profitable” in the long run, that is, the “remainder of income per member” is positive ( $z > 0$ ).

Here, in theory, members engaging in both types of work ( $n_1$  and  $n_2$ ) are motivated to continue their membership in the Kibbutz. This is because they are receiving  $z$ , the “remainder of income per member,” over and above the market wage,  $w_i$ , promised to them outside. A Kibbutz with differential wages will therefore, theoretically, be economically stable and will continue to operate in the long run.

However, this is only true provided that the “Self-Labor” principle (Assumption A.3 of the “Ideal Model” of the Kibbutz) is kept. If, on the other hand, the introduction of outside “hired labor” into the Kibbutz is allowed – a phenomenon almost inclusively prevalent today in all Kibbutzim – then the picture will be completely reversed.

The Kibbutz, for its part, will now prefer employing hired labor, consisting both of highly skilled “white-collar” and of semi-skilled, “blue-collar” members. While the cost of labor to the Kibbutz of employing hired workers is only the market price,  $w_i$ , the cost of employing Kibbutz members is higher, namely  $w_i + z$ .

In this situation, Proposition 1 of [Satt and Ginzburg \(1992\)](#) will come into effect, which this time applies to both types of labor – the “blue-collar,”  $n_1$ , and the “white-collar,”  $n_2$ . That proposition says:

In the long run, the Kibbutz will consist of only those types of labor to which the “Self Labor” principle applies ([Satt & Ginzburg, 1992, p. 693](#)).

In order to maximize  $z$ , the “remainder of income per member,” it will be worthwhile for the Kibbutz to substitute members by hired workers in the margin. Consequently, at any point in time,  $z$  will be higher for the “rest” of

the members. This process will continue in the long run (primarily by discontinuing the absorption of new members, a move that sometimes includes even the younger generation of Kibbutz members) until there remains only one member in the Kibbutz – “the firm’s owner.” In this way, the Kibbutz will complete the entire transition from its “Ideal Model” (LMF) into a competitive firm, CMF.

We will summarize this analysis by a proposition.

**Proposition 2.** The Differential Wage Model of the Kibbutz in the long run, and its transition into a competitive firm.

In the long run, the Kibbutz adopting the Differential Wage Model will disintegrate and disappear as follows:

- If the “remainder of income per member,” is negative, then disintegration will result from the departure of members having a better economic alternative outside the Kibbutz.
- If, on the other hand, the “remainder of income per member” is positive, then the disintegration process will take place in the long run, as a result of the introduction of hired workers, who will gradually replace all members, except one – “the firm’s owner.”

This is in addition to the social pressures applied for deep privatization in all walks of life. In any case, the Kibbutz will disintegrate and disappear as a socio-economic phenomenon.

One may explain the result of Proposition 2 in rather simplistic terms. Once the market prices (wages) of the labor market become the only economic yardstick, either the members leave the Kibbutz (if  $z < 0$ ) or the Kibbutz “leaves” its members (if  $z > 0$ ). In both cases, the Kibbutz no longer exists!

There may, however, be several reservations to the sweeping result of Proposition 2.

The first reservation relates to the possibility that an oligarchic group may evolve in the Kibbutz. The “white-collar” members of the Kibbutz may use their managerial and professional power, at least for a while, to retain their positions before the process of transformation to a competitive firm is concluded. In this case, Michels’s (1915) renowned “Iron Law of Oligarchy” will come into effect.

The second reservation is more technical. It relates to the level of the “community taxation” in the Kibbutz, or to parameter  $\alpha$ . Note that Proposition 2 assumes implicitly that  $\alpha = 1$ , which is to say that the members’ whole (alternative) wage,  $w_i$ , goes to them entirely.

Obviously, in this case, for any positive  $z$

$$\underbrace{(w_i + z)}_{\text{The labor cost of members}} > \underbrace{w_i}_{\text{The labor cost of hired workers}} \tag{13}$$

However, in respect of a relatively lower “differential wage” level ( $0 < \alpha < 1$ ), we are not sure. In fact, we do not know whether

$$\alpha w_i + z > w_i \quad \text{or} \quad \alpha w_i + z < w_i \tag{14}$$

The result depends on the relative size of the parameter  $\alpha$ , and on the absolute sizes of  $w_i$  and of  $z$  (see the numerical example in Appendix B).

This implies that the lower the level of “wage differentiation” in the Kibbutz (parameter  $\alpha$ ), the more stable it will be in this respect. In other words, the Combination Model may be more stable than the “Differential Wage Model.”

The third reservation is closely related to the second one. It deals with the level of “social capital” in the Kibbutz. Theoretically, we may think that the ideological, social, and personal relations and ties among members, that had evolved during the egalitarian era of the Kibbutz (that is, the value of living with people who share common goals and outlooks) may have the effect of maintaining a relatively high level of solidarity (i.e., low  $\alpha$ ). Therefore, by the second reservation, this social value of the Kibbutz might prevent its dissolution for a while.

In reality, however, the prospects for this possibility seems quite poor. A second look at Table and Fig. 1 shows that the Combination Model of the Kibbutz does not grow any stronger over time. On the contrary, it becomes weaker in absolute terms, and certainly relative to the Differential Wage Model.

The fourth reservation relates to the question of whether the Kibbutz may preserve some of its Producer Cooperative characteristics even within a Differential Wage Model. For instance, it may retain the infrastructure of its common production assets in common hands. One obvious example that comes to mind is the *Mondragon complex*, which has paid differential wages since its very institution in 1956. This hypothesis may be possible, at least for the time being. However, it is no longer a Kibbutz in the sense of the “Ideal Model,” defined in Section 3, nor close to it in any sense. Furthermore, and more importantly, note that there is no “hired labor” in Mondragon, so it is not required to deal with this powerful agent of transformation and disintegration that is described in Proposition 2. Thus, our analysis here and the lessons of the Kibbutz may well be a very relevant warning light to Mondragon itself.

This point raises another interesting possibility for avoiding the effects of replacing the Kibbutz members by outside “hired workers.”

Note that  $z$  may be also viewed as (an equal) “profit sharing.” That is, instead of looking at  $z$  as an extra cost of labor to the Kibbutz, it may be considered as a return to members’ common capital. However, to institute and secure the ownership rights for this “profit sharing,” the Kibbutz should first recognize  $z$  as such, and then issue and distribute capital (ownership) shares among the Kibbutz members. This procedure of cooperative ownership has also been applied by Mondragon since its foundation, and contributes to its general stability ([The Institute for Research on the Kibbutz, 1984](#)). That way is clearly more equitable than the accumulation of the capital in the hands of one or a few members, as described above.

In reality, most Kibbutzim that introduced the Differential Wage Model, are still keeping their producing assets undivided. However, some of them are beginning either to sell them outside, or to privatize and distribute them as shares among the members.

Finally, there are also some social and economic relations among Kibbutzim, either at the national – “movement” – level, or at the regional level. It still remains to be seen how meaningful and significant those relations will prove to be.

## 5. SUMMARY AND CONCLUSION

The general object of this paper has been to examine the economic effects of the introduction of the “differential wage” on Kibbutzim and, in particular, to ask whether that “change” signifies the end of the Kibbutz. Our analysis tends to give a positive answer to this last question. The “final curtain” will probably be lowered on the Kibbutz. Moreover, it seems that we are really watching this process in real time!

Note that the introduction of the differential wages is highly significant, since at the ideological level it is the antithesis of the basic principle of the Kibbutz – the “Equal Distribution of Income.”

Kibbutz data show that a decade ago, in 1996, just one Kibbutz had adopted the Differential Wage Model. Since then, the model has made massive incursions and by 2005 it encompassed as many as 156 Kibbutzim out of a total of 264, representing 59% of the Kibbutz Movement. Thus it has progressed at the rapid average rate of 17 Kibbutzim annually.

In general, one can say that it took the Kibbutzim ten years – from the economic crisis of the mid-80s to the mid-90s – to start introducing differential wages. It took another ten years, until 2005, for the model to reach predominant status in over half of all Kibbutzim. Hence, by merely considering the figures, one may advance the “final curtain hypothesis,” stating the possibility that within another ten years or so the model will encompass the whole Kibbutz Movement.

The introduction of the Differential Wage Model into the Kibbutz has two principal sources of motivations: on the one hand, economic pressure for rationalization, while instituting the element of personal motivation into work; and on the other hand, the social tendency toward privatization and personal fulfillment.

As part of our theoretical analysis, based on the LMF Model and its adaptation to the Kibbutz economy, we have found the necessary conditions for the operation – the modus operandi of the production system in the short run – of a Kibbutz that adopted the Differential Wage Model. We have shown that those characteristics are a combination of the characteristics of the Kibbutz in its “Ideal Model” (LMF), and those of a competitive firm (CMF). In addition, we have shown that by introducing the parameter  $\alpha$  – representing the rate of a Kibbutz member’s income out of the “differential wage” – we can generalize and define a continuous sequence of models, from the traditional “Ideal Model,” to the new Differential Wage Model.

However, after examining the long run implications of the Differential Wage Model, we arrived at a far-reaching conclusion. A Kibbutz with differential wages that employs “hired labor,” will disintegrate and disappear in the long run, becoming a capitalist competitive firm.

Some reservations to this sweeping result were proposed. One of them raised the possibility of a transformation into a different kind of Producer Cooperative like the Mondragon complex. However, this transformation would not in any way resemble the Kibbutz in its “Ideal Model” or something close to it. Furthermore, unlike the Kibbutz, the Mondragon complex does not employ “hired labor,” which was shown to be the agent of transformation and deterioration of the Kibbutz.

The main result of this paper reinforces, therefore, the general conclusion we have reached in previous papers as regards to the stability of the Kibbutz economy. From the moment it loses its original mission purpose, and consequently its unique egalitarian cooperative spirit, it is doomed to assimilate into the external socio-economic environment.

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I express my deepest gratitude to the late Professor Haim Barkai for his continued intellectual support and warm friendship over time.

## NOTES

1. Including a few less stable Kibbutzim, sometimes the total number of Kibbutzim reaches 270.

2. However, the “hired labor” component also plays a central role in the disintegration of the Kibbutz with the “Differential Wage Model” (see the analysis in Section 4).

3. The first Kibbutz – Degania, in the Jordan Valley – was founded in the fall of 1910 by 12 members.

4. It is a well-known phenomenon that organizations tend to survive and live, well after having completed their original mission.

5. This claim is a little simplistic. When we incorporate the notion of effort in work, one can claim as unfair the situation of, say, two members who invest different amounts of work (“contribution”) but receive the same salary (“reward”). For more on the “Fairness theory” in the context of the Kibbutz, see for example, Satt, 1996.

6. Sometimes Kibbutzim require even “outside worker” members to first deposit their salary with the Kibbutz. The income is distributed later, after deduction of the “community tax” and the “municipal tax” – according to whichever model they use.

7. This exposition of the “Ideal Model” of the Kibbutz is consistent with Satt & Ginzburg (1992, 1998), and Satt (1996).

8. Some caution is needed at this point. The figure is strictly correct only under the strong assumption of additivity of the various types of labor, namely that  $f_{n_1 n_2} = 0$ . We use this and the following figures for illustration purposes only. However, in the neighborhood of the points of optimality, or as an *ex post* (global) representation, the figures are correct, as the analysis suggests.

9. Sometimes the “Safety Net” also includes payments for special needs, such as health and education, of the economically weak members in the Kibbutz. For simplicity, we assume here that these payments are included in the fixed cost,  $F$ , in the objective function (Eq. (3)).

## REFERENCES

Getz, S. (1998–2003). Annual surveys of changes in Kibbutzim. The institute for research on the Kibbutz, Haifa University (Hebrew).

- Kroll, Y., & Polovin, A. (1997). Productivity and consumption in the Kibbutz at a time of crisis: Measurement and comparison to national statistics. *Journal of Rural Cooperation*, 25, 21–31.
- Michels, R. (1915). Political parties: A sociological study of oligarchic tendencies of modern democracy. Hearst's International Library (translated from Italian).
- Pavin, A. (2003). The differential Kibbutz in the eyes of its members. The Institute for research on the Kibbutz, Haifa University (Hebrew).
- Polovin, A., & Kroll, Y. (1995). Product and disposable income in the Kibbutz. *The Economic Quarterly*, 42, 317–330 (Hebrew).
- Rosner, M. (2003). Distributive justice in Kibbutzim under change. The Institute for Research on the Kibbutz, Haifa University (Hebrew).
- Rosner, M., & Getz, S. (1996). The Kibbutz in an era of changes. The United Kibbutz Publishing and Haifa University, Tel Aviv (Hebrew).
- Rosner, M., Palgi, M., & Goldemberg, H. (2002). Differential budget methods in Kibbutzim and their characteristics. The Institute for Research on the Kibbutz, Haifa University (Hebrew).
- Rosner, M., Orhan, E., Ashush, Y., Goldemberg, H., Getz, S., & Rosolio, D. (2004). The change process in the Kibbutzim – four case studies. The Institute for Research on the Kibbutz, Haifa University (Hebrew).
- Satt, E. (1991). Reward for contribution in the Kibbutz: The lessons of the LMF model. *The Economic Quarterly*, 37(147), 372–386 (Hebrew).
- Satt, E. (1994). On the 'New Kibbutz' Approach. *Economic Quarterly*, 41(1), 132–141 (Hebrew).
- Satt, E. (1996). Relative deprivation in the Kibbutz economy. An exploration of the concepts of equality and equity. *Economica*, 63, s87–s101.
- Satt, E. (2002a). Conceptual problems in measurement of product and disposable income in the Kibbutz. *The Economic Quarterly*, 49, 245–265 (Hebrew).
- Satt, E. (2002b). The comparison of Kibbutz productivity to national statistics: Analysis and remarks. *Journal of Rural Cooperation*, 30(2), 135–157.
- Satt, E., & Ginzburg, H. (1992). On the dynamic effects of using hired labor in the Kibbutz: Theory and case studies. *Journal of Comparative Economics*, 16(4), 688–700.
- Satt, E., & Ginzburg, H. (1998). On the effects of the Kibbutz hiring out its own labor force: Theory and case studies. *Advances in the economic analysis of participatory and labor-managed firms*, 6, 187–212.
- Satt, E., & Sheaffer, Z. (1994). The anatomy of using hired labor in the Kibbutz: Interdisciplinary approach and new data. *Journal of Rural Cooperation*, 12(1–2), 131–147.
- The Institute for Research on the Kibbutz (1984). The relevance of Mondragon Cooperation's experience to the Israeli reality. A discussion paper (Hebrew).
- The Kibbutz Movement (2004). Annual report. The Kibbutz Movement pub. (Hebrew).



## APPENDIX A. LIST OF SYMBOLS

### *Factors of Production*

- $n_1$ : Members of the Kibbutz (workers) of Type 1 (“blue-collar”)  
 $n_2$ : Members of the Kibbutz (workers) of Type 2 (“white-collar”)  
 $N$ : The total number of Kibbutz members. Thus,  $N = n_1 + n_2$ .  
 $K$ : The value of capital  
 $F$ : The fixed cost

### *Prices*

- $w_1$ : The market wage-rate of Type 1 (“blue-collar”) workers  
 $w_2$ : The market wage-rate of Type 2 (“white-collar”) workers  
 $r$ : The rental rate of capital  
 $P$ : The market price of the product ( $y$ ). All prices are assumed to be (exogenously) given to the Kibbutz

### *Production and Income*

- $y$ : The amount of aggregate product  
 $f(\cdot)$ : The (neo-classical) production function, where  $y = f(\cdot)$   
 $pf_{n_1}$ : The value of marginal product of a “blue-collar” member in the Kibbutz production  
 $pf_{n_2}$ : The value of marginal product of a “white-collar” member in the Kibbutz production  
 $pf_K$ : The value of marginal product of capital  
 $v$ : The income per member in the Kibbutz  
 $z$ : The “remainder of income per member” (after the “differential wages”) in the Kibbutz

In general, the optimal values are denoted by asterisks (\*); specific levels of the variables, by additional (relevant) superscript or subscripts.

## APPENDIX B. SIMPLE NUMERICAL EXAMPLES OF VARIOUS “DIFFERENTIAL WAGE” MODELS

1. Assume a Kibbutz with only two members:
  - *Member No. (1)* is a semi-skilled “blue-collar” worker. His alternative wage ( $w_1$ ) in the labor market is \$ 1,000 per month.

- *Member No. (2)* is a highly skilled “white-collar” professional manager. His alternative wage ( $w_2$ ) is \$ 4,000 per month. (*The ratio* between the market wages of the two members is 4/1).

2. The total income of the Kibbutz, after paying the external production inputs (including the cost of capital) is \$6,000 per month.
3. The Kibbutz, which started from the basic position of the Egalitarian Cooperative Model, has decided to adopt the “change process.”

We shall now examine the “overall income” levels of the two members using different models (different relative levels of  $\alpha$ ).

As a rule, the “overall income” of *Member No. (1)* (“blue-collar”) is, in this case:

$$\alpha w_1 + z = \alpha * 1,000 + z = \alpha * 1,000 + (6,000 - \alpha * 5,000)/2$$

In the same way, here the “overall income” of *Member No. (2)* (“white-collar”) is

$$\alpha w_2 + z = \alpha * 4,000 + z = \alpha * 4,000 + (6,000 - \alpha * 5,000)/2$$

The computations for the numerical example data in Table B1, generate a rising *sequence of models*:

- The “Egalitarian Cooperative Model”:  $\alpha = 0$
- The “Combination Model”:  $\alpha = 0.2$
- “Middle of the Road” (a designation given here):  $\alpha = 0.5$
- “Differential Wage Model” with “Safety Net”:  $\alpha = 0.8$
- “Differential Wage Model” without “Safety Net”:  $\alpha = 1$

**Table B1.** Members’ “Total Income” (According to the Various “Differential Wage” Models): Numerical Example Data (Monthly Wage Rates in \$).

Member	“The Egalitarian Cooperative Model”	“The Combination Model”	“Middle of the Road”	“Differential wage” with “safety net”	“Differential wage” without “safety net”
	$\alpha = 0$	$\alpha = 0.2$	$\alpha = 0.5$	$\alpha = 0.8$	$\alpha = 1$
No. (1): “Blue collar”	3,000	2,700	2,250	1,800	1,500
No. (2): “White collar”	3,000	3,300	3,750	4,200	4,500
Total	6,000	6,000	6,000	6,000	6,000
Difference (2) – (1)	0	600	1,500	2,400	3,000
Ratio (2)/(1)	1/1	1.2/1	1.7/1	2.3/1	3/1

## APPENDIX C. A SAMPLE OF GENERAL DEMOGRAPHIC AND ECONOMIC DATA OF THE KIBBUTZ MOVEMENT TODAY

The following data are taken from the latest *Annual Report of The Kibbutz Movement (2004)*; the Report summarizes the essential data up to and including 2003.

### I. General Demographic Data

1. *The overall population* of the Kibbutz Movement is about 100 thousand people, which is about 1.5% of the total population of Israel. More precisely, in 2003 there were about 98 thousand permanent members and children and about 18 thousand temporary residents.
2. *The demographic balance* of the Kibbutz in recent years is negative. Whereas in 1998 the permanent population amounted to about 105 thousand, it decreased over a five-year period by 7%, reaching 98 thousand in 2003. This seems to be a continuing situation.
3. *The age distribution* of the Kibbutz population is older than that of the general population in Israel. For example, within the 0–22 years age-range, we find 25.3% in the Kibbutz, comparing to 35.1 in the general population. However, in the 70–99 age-range, the numbers are 10.2% in the Kibbutz and 6.9% in the general population.
4. *The mode of size* of the Kibbutzim is about 500 people.
5. *The mode of age of the Kibbutzim* (how many years ago they were founded) is about 60 years.

### II. General Economic Data

1. *The production activity* of the Kibbutzim is based on agriculture, manufacturing, services, and “outside worker” industries.
2. *The volume of sales* of the Kibbutz Movement was about 6 billion dollars in 2003.
3. *The shares of the different industries*, in the total sales of the Kibbutz in 2003, were:

Agriculture:	19%
Services:	6%
“Outside workers”:	6%
Manufacturing:	69%
Total:	100%

4. *The share of the agricultural industry of the Kibbutz* in general agricultural sales in Israel was about 33% in 2003.

5. *The share of the factory industry of the Kibbutz* in general factory sales in Israel was about 12% in 2003.
6. *The “GNP”* (“Gross ‘National’ Product”) of the Kibbutz Movement, its own value-added, is about 1.5 billion dollars per year. (Note that the GNP of Israel is in the order of magnitude of 100 billion dollars per year. For a more thorough discussion of conceptual and empirical problems in measurements of the Kibbutz (own value-added) GNP, see, for example, Polovin & Kroll (1995), Kroll & Polovin (1997), and Satt (2002a, 2002b).

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# THE QUALITY OF MANAGEMENT IN BASQUE COMPANIES: DIFFERENCES EXISTING BETWEEN COOPERATIVE AND NON-COOPERATIVE COMPANIES<sup>☆</sup>

Jon Charterina Abando, Eneka Albizu Gallastegi and  
Jon Landeta Rodriguez

## ABSTRACT

*This study analyses and presents the main differences that exist in the quality of management as practised by Cooperative and Non-Cooperative companies in the Basque Country within the industrial and company services sectors. The results obtained suggest that the quality level of cooperative company management is higher than that shown in the non-cooperative sector, the principal differences in quality of management being related to aspects where the social commitment of a company is reflected. These results prove to be more conclusive within the subgroup of cooperatives that are incorporated within the Mondragon Cooperative Corporation (MCC).*

<sup>☆</sup>An early version of this work was presented in “The Mondragon Co-operative Research Conference 2005”, held in Oñati, Spain on June 28th, 2005.

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## 1. INTRODUCTION

Quality of management is a critical dimension where entrepreneurial competitiveness is concerned.<sup>1</sup> This is so because, more important than the way in which the competitiveness of a company is affected due to belonging to a particular industry or being located in a specific region, entrepreneurial competitiveness depends, to a good degree, on internal factors, as is suggested by resource-based theory.<sup>2</sup>

The analysis of resources and skills, therefore, makes it possible not only to explain the success of companies that are appreciably different from one another, but also understand why many companies find it difficult to imitate and develop the resources and skills that characterise other companies.<sup>3</sup>

Among these skills there are some that are repeatedly referenced as particularly critical. Galán and Vecino (1997) point to the capacity of business management, a variable that is correlated to the entrepreneurial dimension, as the “*true cause of profitability*”. Similarly, Cuervo (1993) considers that the variability of business results is to be explained, above all, by the development of managerial skills, in as much as they make it possible to develop and accumulate the intangible assets that generate the competitive advantages of a company. Ruiz-Carrillo and Fernández (2005) also suggest that managerial capability is present in the European quality model, which is, as they demonstrate, implicitly based on the resource-based theory.

However, the quality of business management is a dimension that has not been subjected to much research at an international level<sup>4</sup> and, to be more specific, studies of this nature are unknown within the confines of the Basque Country. Our contribution will, therefore, be classified within the following context: the study of the quality of company management in the Basque Autonomous Community (BAC).<sup>5</sup>

The Basque Country<sup>6</sup> presents a business mesh with features that are specific and, therefore, different from those of Spanish companies. One key line of differentiation is that Basque companies have a more marked industrial profile. 8.43% of companies in Spain belong to this sector, while the equivalent figure for the Basque Country is 8.8%.<sup>7</sup> Nevertheless, if we analyse the industrial sector in detail, 50% of the Gross Added Value (GAV) of Basque industry is basically concentrated in two subsectors associated with the metallurgical industry: *Production and Transformation of Metal Products* (32.3%) and *Machinery and Mechanical Equipment* (15.2%), while in the Spanish State these two sectors represent only 20.6% of GAV (12.9% and 7.7%, respectively). On the other hand, the negative differential in GAV terms is manifested in greater intensity in two subsectors associated

with the transformation of products in the primary sector, these being: *Food, Drinks and Tobacco*, or *Textiles and Clothing, Leather and Footwear*, where BAC companies do not contribute more than a tiny proportion of the GAV when compared with companies in the rest of Spain (1.4% as against 24%, respectively).

Also while in 2003 the Basque industrial sector produced 28.04% of total employment (Eustat, 2003) (27.38% from manufacturing industry), in the Spanish State the industrial sector only accounted for 18.71% of employment (Ministerio de Trabajo y Asuntos Sociales, 2003).

Another area where there are differences between Basque and Spanish companies is that of company size. In the Basque business structure there is a greater proportion of medium and large-scale enterprises and, correspondingly, more jobs are generated in these kinds of companies than in Spanish firms, where micro and small-size businesses have more weight. This circumstance is reflected in Table 1.

But the dimension in which the entrepreneurial mesh of the BAC probably differs most from the situation at State level, and from the rest of the world, has to do with the distribution of industrial companies where their juridical status is concerned. In the BAC, 0.95% of businesses belong to Cooperative societies, while the corresponding figure for the Spanish State is 0.91%.<sup>8</sup> However, what is striking is the important weight of cooperatives associated with the industrial structure in the Basque Country. In Table 2, compare the second column with the others.

As may be seen from Table 1, the proportion of cooperative companies in the BAC tends to rise in line with an increase in company size, to a point where it occupies 21% of the total companies with more than 500 employees. And there is an important presence of cooperatives within the companies in the industrial sector, while, likewise, their participation in the sector increases as business size becomes greater, reaching 34.2% of

**Table 1.** Company and Employment Percentages for BAC and Spain.

	< 10	10–49	50–249	> 250
No. of companies (% total)				
BAC	94.1	4.8	0.9	0.2
Spain	93.0	6.2	0.7	0.1
Employment (% total)				
BAC	35.0	19.2	17.5	28.4
Spain	40.6	24.4	14.8	20.3

Source: Navarro and Buesa (2004, p. 74). Drawn up using data from 2000.



**Table 2.** Cooperatives within the Basque Entrepreneurial Mesh.

	Percentage of Coops within Total No. of Companies in the BAC	Percentage of Coops within Total of Industry and Energy Companies	Percentage of Coops within Total of Construction Companies	Percentage Coops within Company Total for Commerce, Catering and Transport	Percentage Coops within Total for Banking, Insurance and Company Services	Percentage Coops within Total for Companies Offering Other Services
Total	0.6	2.3	0.4	0.3	0.5	0.6
≤ 19	0.6	3.7	0.5	0.3	0.5	0.4
20–49	2.6	3.7	0.9	2.2	2.1	2.6
50–99	5.3	4.9	2.0	1.9	3.9	8.3
100–249	5.1	7.6	0.0	3.2	2.2	4.3
250–499	8.1	13.9	0.0	0.0	3.5	2.8
≥ 500	21.0	34.2	0.0	22.2	10	0.0

Source: Own work using data supplied by EUSTAT (2003).

industrial companies with more than 500 employees. The weight of cooperatives from the sectors of Banking, Insurance and Company Services is also considerable.

Cooperatives have an important impact, too, in terms of employment generated in the BAC. So, of the 806,220 jobs existing in 2003, 41,956 corresponded to the Cooperative sector, which means that Coops account for 5.2% of jobs in the Basque Country.

In the group of industrial cooperatives in the Basque Country, the Mondragon Cooperative Corporation (MCC) occupies a frontline position. According to the MCCs Annual Report of 2003, in its industrial division it groups together 29 Coops located in the BAC, providing employment to 8% of the population employed in the industrial sector in this region and exporting 49% of its production. Furthermore, it can rely on a powerful network of business service companies, apart from another six companies dedicated to financial services, insurance and social security.

The statistics corresponding to the cooperative sector, mentioned above, are very striking, particularly if we compare them with the international information available to us. In the European Union, where there are 122,304 Cooperatives comprising 70,612,593 members (ICA, 1998), Coops generate roughly 2.3% of the equivalent of full-time paid employment, the relative weight of the sector varying between 4.58% in Spain, and the 4.48% for Finland to 0.57% in Greece and 0.66% in the UK (Comisión of the European Communities, 2001).

The societal set-up of cooperatives makes them quite singular companies, with features that set them apart from standard capitalist companies.<sup>9</sup> So,

within the work programme we are engaged in, we posed ourselves the following question for research:

Within the industrial and company services sectors, are there significant differences in the area of quality of management between limited liability companies and cooperative societies? In what form are these differences materialised? What explanation do they have?

Consequently, the main objective of our study is to identify these differences and propose reasons that explain them.

With this study, therefore, we hope to contribute a reflective view, founded on comparative empirical data, concerning the influence of the conditions that are proper to cooperative societies in general, and to the Mondragon cooperative group in particular, on the quality of its business management, when compared with non-cooperative companies from the same geographic ambit.

We are unaware of the existence of work that has undertaken an evaluation of the global quality of the management practices of our random samples of cooperative and non-cooperative companies. This study, therefore, intends to provide, within its limitations, cooperative movement experts and managers with new elements for reflection on cooperative management, taken from a very particular context, that of the Basque Country, as we are aware that one of the main challenges facing cooperatives in the 21st century is to improve the management abilities of their managers (Davis, 1999).

For this purpose, our work develops over five sections, in addition to this first introductory opening. The second part is given over to presenting the theoretical fundamentals that can help us predict and explain differences in the management quality of cooperatives. In the third we explain the methodology followed in the empirical work, while the fourth serves to present and discuss the results obtained. We devote the last two sections to the establishment of conclusions and discussion of the limitations of our research, respectively.

## **2. COOPERATIVES AND THE MONDRAGON GROUP**

### *2.1. Cooperatives and Their Management: Distinguishing Features*

From its beginnings, the desire of the cooperative movement, in order to achieve genuine economic and social progress, was that the profits obtained

from the performance of a business activity ought to revert to the principal generating factor – mankind. So, it was seen as a necessity that cooperative members should contribute capital and work and, consequently, get involved in the adopting of decisions, and in all kinds of responsibilities that derive from carrying out their activity<sup>10</sup> (Albizu & Basterretxea, 1998).

Starting from these premises, cooperatives constitute an entrepreneurial type with very clear distinguishing characteristics (Barton, 1989; Helmberger & Hoos, 1964), such as property rights and decision-making processes. Likewise, cooperatives are companies that are governed by Cooperative Principles,<sup>11</sup> which differentiate them from capitalist companies (García-Gutiérrez, 1994). This reality has its repercussions on entrepreneurial behaviour and, subsequently, should be reflected in some way in the management performance of those in charge.

Logically, as companies, which indeed they are, despite their singularities, cooperative companies cannot be indifferent to the fundamentals and tendencies of modern business administration (Vargas, 1999a). There is a growth in the literature (Fernández, 2006; Vivet & Thiry, 2000; Chaves, 1997; Bager, 1994; Belley, 1988) that emphasises that once cooperatives reach a certain size, they begin to develop competitive behaviours that are increasingly less differentiated in relation to non-cooperative companies. This phenomenon of distancing from cooperative principles and consequent proximity to the standard patterns of management in capitalist firms has been called “cooptalism”, “isomorphism” or “decooperativisation”. Parallel to this phenomenon, there exists the emergence of a new generation of cooperatives that appear to be organisational hybrids combining aspects of investor ownership and cooperative ownership structures designed to overcome specific limitations in order to compete successfully (Katz & Boland, 2002).

This does not prevent a growing number of companies in economically developed countries from obtaining important results on the economic and social plane whilst remaining faithful to their identifying ideas. Some documented proof of this increase, though our intention is not to provide an exhaustive list, is provided by: the European cooperative banking sector (Molyneux, 2005); the agricultural sector in the European Union and the United States of America (Cropp & Ingalsbe, 1989; Van Bekkum & Van Dijk, 1997); the food and drinks sectors (Vargas, 1999a) or the well-known case of the MCC in Spain (Bradley & Gelb, 1981; Thomas & Logan, 1982; Woodworth, 1986; Albizu & Basterretxea, 1998). In addition, conclusive evidence has not been provided to the effect that cooperatives tend to be less efficient than investor owned firms (see overviews in Sexton & Iskow, 1993;

Gentzoglanis, 1997). Finally, there is a current of thought that argues that cooperatives, due precisely to their organising characteristics based on cultural participation, have a greater facility in obtaining better business performance (Abell, 1985; Vargas, 1995, 1999b; Agirre, 2001; Spear, 2000; Aranzadi, 2000).

If, as the results of this research suggest, the cooperative sector is capable of competing successfully in a developed globalised economy, it will be due in some degree to certain qualities that are intrinsic to this entrepreneurial typology.<sup>12</sup> Our purpose, therefore, is to concentrate on the differentiating elements of business management in cooperatives. So we will concentrate on cooperative principles that “attract” efficient management (Agirre, 2001). That is to say, we will refer to dimensions of management where one might expect to find greater differences of behaviour in comparison with typical capitalist companies. Following Professor Agirre, the main idiosyncratic elements of cooperatives that would affect business management are: the principle of democratic organisation; the principle of education; and the principle of intercooperation.

### *2.1.1. Principle of Democratic Organisation*

The *principle of democratic organisation*, as it is currently perceived by the ICA, means concretely that:

“Co-operatives are democratic organisations controlled by their members, who actively participate in setting their policies and making decisions. Men and women serving as elected representatives are accountable to the membership. In primary co-operatives members have equal voting rights (one member, one vote) and co-operatives at other levels are also organised in a democratic manner”.

ICA (2006) <http://www.ica.coop/coop/principles.html>

From this principle are derived two fundamental characteristics: *participation/control in management* and the *right to information*.

Within the context of democratic organisation manifested by cooperatives, the worker-associate has a marked range of possibilities for participation in the adoption of decisions, which constitutes a fundamental feature of the government and management of cooperative companies as against capitalist companies. Some of the spheres of participation in the adoption of decisions by the worker-owners are (Rhodes & Steers, 1981): serving on the board of directors; electing members to the board of directors, hence being afforded an indirect say in policy decisions; voting on certain critical issues at share meetings; working side by side with board members, providing the worker-owner with informal influence; and voicing complaints and suggestions freely to the general manager.

Beyond the information rights of workers stipulated by the social and working regulations in force in each country, information is an inalienable right of cooperative associates (Agirre, 2001), stemming from the principle of democratic organisation, as well as a key element that enables people in the organisations to become involved.

Different empirical research demonstrates that the worker-owner status produces: higher identification with company goals (Long, 1978a; Russell, Hochner, & Perry, 1979); greater job satisfaction (Russell et al., 1979; Greenberg, 1980; Rooney, 1992); worker involvement and organisational commitment (Long, 1978a, 1978b; Rhodes & Steers, 1981); and benefit provision for workers (Rooney, 1992).

### 2.1.2. *Principle of Education*

The *principle of education*, as defined by the ICA (2006), means that:

“Co-operatives provide education and training for their members, elected representatives, managers, and employees so they can contribute effectively to the development of their co-operatives. They inform the general public – particularly young people and opinion leaders – about the nature and benefits of co-operation”.

ICA (2006) <http://www.ica.coop/coop/principles.html>

The role of training in the cooperative world has frequently passed unnoticed.<sup>13</sup> Nevertheless, the importance of training as expressed in cooperative principles has been made clear by prominent ideologues of the cooperative movement such as Father Arizmendiarieta, principal promoter of the Basque cooperative movement, in statements like the following:

“The investments that are destined to be most fruitful and interesting for all, are those we are able to and must make for more determined action for the cultural promotion of the new generations”.

“Education is economy, because without education one cannot produce or distribute either goods or services”.

“To sow in time is to provide professional preparation for our youth. This is the expense that transforms into a seed to produce one hundred and one per cent”.

J.M. Arizmendiarieta, in Azurmendi (1992)

### 2.1.3. *Principle of Intercooperation*

The *principle of intercooperation* states that intercooperation between cooperatives becomes fundamental for its survival and development in a competitive globalised world and, in fact, it has been the special subject of attention in recent discussions of the ICA and the Commission of the European Communities (CEC), among others. Thus, intercooperation through the establishment of partnerships and mergers proves to be

indispensable in sectors with the presence of cooperatives where the market trend is concentration and an increase in competitiveness (i.e. banking, insurance, retail, food transformation etc.) (CEC, 2001).

The principle of intercooperation states that:

“Co-operatives serve their members most effectively and strengthen the co-operative movement by working together through local, national, regional and international structures”.

ICA (2006) <http://www.ica.coop/coop/principles.html>

In accordance with this principle, the dynamic of establishing agreements and partnerships between companies should be amply rooted in the cooperative world. Business praxis demonstrates that, in addition to the establishment of agreements with cooperative companies, defining agreements with other kinds of companies is, today, a current economic trend among cooperatives (Vargas, 1999a).

According to what has been shown throughout this section, and in line with the dimensions considered within the European Foundation for Quality Management (EFQM) model of management excellence, cooperatives ought to display different behaviour from that of capitalist firms in:

- *Shared leadership.* That is, they ought to show greater worker participation in the shared fixing of objectives and strategies, since these should be passed by the associates' meeting. Likewise, the objectives and strategies ought to be widely known by the members by virtue of the rights cooperative members have to management control. Finally, they should have more developed systems of teamwork with decision-making capacity, by virtue of the values of mutual self-help and corresponsibility within each cooperative society.
- *Training and development.* Because of the education factor expressed in cooperative principles, cooperatives ought to display continual tension in their efforts to identify cooperative members' training needs, get training plans moving and promote the maximum participation of worker-associates in training plans developed by the cooperative.
- *Internal communication and social audit.* In policies of people management, which should be more advanced in cooperatives, it would seem logical for these companies to be sensitised in wishing to know the state of the atmosphere at work, to establish a panel of social indicators and to activate internal communication plans so as to achieve a greater degree of information and involvement of associates in the organisation.
- *Relations with outside collaborators.* In line with the growing trend towards intercooperation and inter-business cooperation that has taken

on in the cooperative world, Coops ought to display a strong tendency to establish agreements with suppliers; with other organisations with a view to sharing resources and developing skills; and with other organisations of a social nature situated in the communities where the cooperatives are located.

## *2.2. The Mondragon Cooperative Corporation (MCC)*

The origins of what is today the MCC go back to October 1955, when a group of five students from the Professional School of Mondragon acquired Talleres Ulgor, a small firm from Vitoria devoted to the manufacture of oil stoves. A year later they transferred the firm to Mondragon, and in March 1959 they obtained the approval of the first statutes as an industrial cooperative society (Urdangarín, 1999).

The determination and organisational ideas of Father D. José María Arizmendiarrreta proved to be crucial for the MCC project to be able to take shape and move forward. In 1959 the Caja Laboral Popular (CLP) was created, a credit cooperative society designed to finance and assess the development of cooperative companies. Comprising both natural persons and cooperatives, the CLP initially took on the task of planning the expansion of the Associated Group (Albizu & Basterretxea, 1998). In 1966, Lagun Aro, from the Social Section of the CLP, took its first steps in response to the situation of defencelessness in which cooperative members had found themselves since 1958, due to a Ministry of Work order excluding them from the General Social Security System. In addition, this initial period reveals a marked dynamism within the Group, with the creation of cooperatives as well-known as Eroski, Fagor, Ederlan, Irizar and Danobat.

Between 1970 and 1984 the Associated Group continued to diversify, this time with more planning than in previous years (Moye, 1993). The Business Division of the CLP evolved a methodology for studying the viability of new projects and to gain in resource mobility. However, the last years of this period were particularly problematic for Basque industry, because of the recession that was hitting it, reflected in the fact that the rhythm of cooperative creation in the Group was almost completely halted. The Group made a special effort in order to keep up employment levels during the last years of this period. The diversification strategy was suspended and a Department of Intervention was even created within the CLP Business Division to act in associated cooperatives in crisis that required assistance.

In the second half of the 1980s the Basque economy recovered, and the strategies of consolidation and growth were taken up again. The Group

experienced a reorganisation to tackle the foreseeable consequences both European integration and globalisation. In 1987, after the closing session of the Group's 1st Congress, MCC was set up, this being a voluntary inter-cooperative federation with the mission of accumulating and redistributing the resources of the Group, centralising certain services and taking advantage of organisational synergies. This brought with it the modification of the conditions for participation in the Group, with precedence given to economic-business arguments and, in particular, the securing of economies of scale, whilst attempting to transcend the social, juridical and formal features that had been dominant until then. In this context, approval was given to the creation of a holding company, allowing Group to take out shares in other capital societies (Albizu & Basterretxea, 1998).

Meanwhile, the cooperative congresses of 1989 and 1991 represented an important change with the strengthening of Central Services (Cooperative Centres) and the regrouping of the component cooperatives, moving from a geographical foundation to one based on markets or shared technologies (Whyte, 1995; Urdangarín, 1999). Similarly, the structure of the Group was defined in the shape of three sector groups: the Financial Group, led by the CLP, the Industrial Group, with its seven division configuration, and the Distribution Group, led by Eroski.

One memorable milestone on MCCs path over recent years was the creation of Mondragon University in 1998 through the fusion of the Polytechnic School of Mondragon and other Group training centres. At present, MCC groups together a total of more than 200 societies with different juridical statuses. To cite the most outstanding figures, in 2004 MCC obtained total sales of 10,459 million euros, and provided employment to 70,884 people (MCC Annual Report, 2004).

At a world level, the interest of several researchers has been drawn to the success of MCC and its peculiar cooperative-based organisation, as a counterexample to the general impression that workers' cooperatives have only a slight capacity for long-term growth and survival, in comparison to other capitals societies (Whyte & Whyte, 1996, p. 3). Many authors understand that this success is founded on the promotion and maintenance of certain values and principles. Cheney (2001), for instance, considers one success factor to be solidarity, which is particularly common in Spanish and Basque society and materialises in a commitment to other people and in a feeling of belonging to the place or region one comes from. Mollner has the understanding that MCC cooperative associates have shared the need to achieve a state of common welfare as a basic priority, to a point where the employee is placed ahead of managers, product and capital, in that order (Mollner,



1994, p. 85). Some work concentrates on the interpretation given by Father Arizmendiarreta<sup>14</sup> to the basic principles of the cooperative movement,<sup>15</sup> and on how they have given shape to the structure of social relations in cooperatives and in MCC as a whole (Agirre, 2001; Albizu & Basterretxea, 1998; Whyte & Whyte, 1996). A very important question in this respect is the insistence given to the necessary balance between the private interests of the associates and the common benefit of the Group, and the way in which, within MCC, mechanisms have been successfully articulated in order to sustain this situation (Forcadell, 2000; Taylor, 1994; Whyte, 1995).<sup>16</sup>

Other aspects have also been repeatedly mentioned. There is agreement in stressing the fundamental work that has gone into financing and guidance in the creation and management of cooperatives, developed by the CLP from when it was set up. Likewise, emphasis has also been given to factors like training and internal communication between its members,<sup>17</sup> and the design of new structures for participation in the decisions of cooperatives both by consumers and by workers, or farmers and workers (in the case of agricultural cooperatives) (Whyte, 1995).

### 3. METHODOLOGY

In order to achieve the main objective of this research, which is to measure the quality of management in cooperative and non-cooperative companies and analyse where the main differences reside, if differences do exist, we made a comparison of management in non-Coops, concentrating on the dimensions where there is a breakdown of the key factors taken into consideration by the EFQM model.<sup>18</sup> This model incorporates all the variables that we had previously identified in our bibliography review concerning the determining features of quality management, relates one to another, gives them a specific weighting and, above all, is known and has been relatively accepted by Basque companies,<sup>19</sup> which helped managers to correctly interpret and respond to our questions. This is why we rejected the option of creating our own model or of using another alternative model. Consequently, using the variables in the EFQM model, we crafted an instrument for gathering information so that we could analytically assess the management quality of companies; constructed different partial and global quality indicators; defined the population of companies forming the subject of the study as those employing more than 50 workers in the BAC; and designed a representative sample of companies, in accordance with criteria of size and

juridical status. The information was obtained via telephone interviews and was processed using SPSS and Excel programmes.

### *3.1. Making the Questionnaire*

A prior step the research team took before carrying out the fieldwork was to draw up a questionnaire taking as reference EFQMs self-assessment questionnaires for Small and Medium Enterprises (SMEs) and the limitations inherent in the type of survey chosen (consultation by telephone).

The questionnaire comprised 40 questions asking whether the company did or did not employ management practices (and/or tools) generally accepted as good practices, or advanced management practices. The questionnaire, therefore, was oriented principally towards the measurement of the “formal” quality of business management, as an external, approximate manifestation of its real quality.

The practices and tools selected were arranged into five basic groups that explained, a priori, the business results. These corresponded with the *Enablers in the EFQM model*. Each of these five groups or key variables included, as indicated in Table 3, other variables intended to contribute to improving the analysis of management quality.

In Table 3 we present, in accordance with the arguments expounded, the key factors in the EFQM model (its criteria), the main variables that have been considered in this study and also the dimensions into which they have been broken down.

As an additional guarantee of its validity, the initial questionnaire was tested out in 20 telephone interviews with Basque managers. Due to this test we were able to sharpen up the formulation and content of various questions.

The reliability or internal consistence of the questionnaire, that is, the degree of concordance exhibited by the items that measure a same variable or factor, was measured using Cronbach’s alpha coefficient (1951). In accordance with Nunnally (1978), it can be said that internal consistence exists starting from 0.60 values in this coefficient. Nevertheless, Van de Den and Ferry (1979) lower the minimum level to 0.55. Around these references, the Alpha coefficients were calculated for the key variables of Leadership, Strategy, People, Partnerships/Collaborators and Resources and Processes, considering the total of the initial sample. Table 4 shows the reliability coefficients obtained for each of these factors.

As can be observed, in all the cases the minimum value of 0.55 is surpassed.

**Table 3.** Key Factors in the EFQM Model, Variables and Dimensions into Which They are Broken Down.

Key Factors in the EFQM Model	Variables Under Consideration	Dimensions into Which the Variables are Broken Down
Leadership	Commitment to improvement	Training in management techniques Conscious transmission of values Active thrust for improvement projects
	Shared leadership	Joint establishment of objectives and strategies Objectives and strategies known by the company Teamwork with capacity of decision
People management	Training and development	Identification of desired profiles Existence of training plans Participation in training actions
	Compensation policy	Managers with variable salaries Workers with variable salaries Employment of non-salaried systems of compensation
Policy and strategy	Internal communication and social audit	Internal communication plan Panel of social indicators Surveys and interviews with workers
	Technification of management strategy	DAFO diagnosis Document with objectives and strategies Adaptation of strategy/structure Panel of objective indicators and management Product and client profitability analysis EFQM or similar self-assessment
Partnerships and resources	Capture of relevant external information	Benchmarking File of competitors in accordance with competitive profile
	Relationship external collaborators	Register of suppliers Collaboration with suppliers Agreements for sharing resources Social action in relation to the community
Processes	Internal resources	Computerised treasury management system Internet in commercial relations Application of "5 s" technique Insurance for commercial operations Knowledge management
	Internal management of processes Customer and market orientation	External accreditation (ISO or others) Review and process improvement systems Systems for detecting customer requirements

**Table 3.** (Continued)

Key Factors in the EFQM Model	Variables Under Consideration	Dimensions into Which the Variables are Broken Down
		System for measuring customer degree of satisfaction Complaints and claims management system Customer performance indicators Execution of periodic market studies In-house dissemination of information concerning customers

Source: Own work using EFQM model.

**Table 4.** Reliability Coefficients for Each EFQM Model Variable.

Variable	No. of Cases	Alpha
Leadership	796	0.7785
People	767	0.6370
Policy and strategy	482	0.7073
Resources and collaborators	625	0.5924
Processes	811	0.7444

### 3.2. Constructing the Quality Estimators

To build the quality estimators we based ourselves on EFQM criteria and on their relative weights within the model.

A partial quality indicator was made for each of the criteria studied, the general indicator being the weighted sum (in line with the weightings included in the EFQM model for the agents) of each of the partial indicators.

The partial indicators for each criterion were constructed as the average of the scores obtained in all the items referring to the criterion in question. To do this, the responses obtained in each item were originally considered with a polytomic scale, giving the value zero (0) in the case of a negative reply, and values of 1 to 5 in the case of an affirmative reply, in accordance with the time during which the company had been applying the tool in question.<sup>20</sup> Later, for the response frequency comparisons, developed in Table 13, this original scale was transformed into a dicotomic variable of the YES (1) or NO (0) type, grouping under *Yes* all the cases where the response was “*Yes, we do it*”, independently of how long they had been doing it.

From the original multinomial scale of replies, the indicators were constructed from item averages. In particular, the *Leadership* variable indicator was made from 6 questions, the *People* indicator from 9, that for *Policy and Strategy* from 8 questions, the *Collaborators and Resources* indicator was made with 9 and the *Processes* variable indicator, once again, with 8.

Finally, the Global Quality Indicator<sup>21</sup> was calculated by weighing the partial estimators, in line with EFQM criteria.

### *3.3. Definition of the Population Studied and Sample Framework*

The study was carried out considering as its population all companies with 50 or more employees and whose offices are registered in the BAC, from the industrial and services sector. For this, the *Duns 50,000* records for 2003 were taken as the base.

The exclusion of companies with less than 50 workers is due to the approach adopted in this research, which, necessarily, implicitly associated management quality with the formal putting into practice of specific management actions. It is not entirely suitable for measuring management in small firms, where the absence of a formalisation of good practices cannot necessarily be associated with bad management, just as formalisation of the same does not obligatorily point to good management. Consequently, we prefer to exclude them from the research, rather than present results about their management that are difficult to interpret and comparable with other business sizes.

After the elimination of companies that presented incomplete information concerning the pre-selected fields necessary for the investigation, the total number of companies with 50 or more employees, located in the BAC and also registered there, was 1,221, and this, therefore, constituted the sample framework for the study. Of these 1,221 companies, 93 were Coops.<sup>22</sup>

The company population of the BAC was classified in accordance with criteria of Size (number of employees), Sector and Juridical Status, as we wished to test out whether, in addition to juridical status, the size of a company and/or its sector of activity had an influence on the degree of formal quality in the way it was managed. So, the population was distributed as indicated in Table 5.

### *3.4. Obtaining the Sample*

With this sample framework as our point of departure, we opted for a random stratified sampling procedure in accordance with the criterion of

**Table 5.** Classified Sample Framework of Basque Companies.

	Between 50 and 99 Employees		Between 100 and 249 Employees		250 Employees or More		Total		Total
	Non-Coop	Coop	Non-Coop	Coop	Non-Coop	Coop	Non-Coop	Coop	
Ind.	378	24	204	16	103	23	708	63	771
Serv.	229	9	136	16	78	5	448	30	478
Total	607	33	340	32	181	28	1,156	93	1,249
	640		372		209		1,249		

*Company Size* (defined by the number of employees), for a confidence level of 95.5% and a maximum degree of error of 5%, in each of the three size strata chosen, for non-cooperative juridical status. Where the cooperatives were concerned, given their limited number, no sample was extracted, and instead the entire population was used. With regard to the *Sector of Activity* criterion, a proportional assignment was also adopted for the non-cooperative sampling group.

The information we were seeking from the selected sample was obtained via approximately 20-min-long telephone interviews during the month of April.<sup>23</sup> The essential reason that led us to choose this approach route to managers was the desire to guarantee the greatest response index possible, as the size of the sample on which we had to work was very large in proportion to the total company group. The telephone interview, because it requires less response time and provides direct access to the interviewee, is especially useful for accessing the top manager group, for instance, who have little time, or motivation, to devote to postal questionnaires or personal interviews (Brand, 1984, p. 45; Reeder, Brierty, & Reeder, 1991, p. 174).

The interview was aimed at the highest-ranking company managers or, failing that, at functional managers (principally, quality, commercial and financial directors). Previously, all the managers selected were sent a letter presenting the study and, for those who so requested, a copy of the questionnaire, with the aim of making it easier for them to collaborate. On 48% of the occasions, those who provided the answers held the top-level posts in the companies (managers, general directors, single administrators or presidents), while in 52% of the interviews those who participated were functional directors or other types of executive.

In the end, we managed to conduct 503 valid interviews, representing roughly 50% of the sample framework. In the case of the non-cooperative companies this gives a representative sample from the framework with a

**Table 6.** Composition of the Definitive Company Sample.

	Between 50 and 99 Employees		Between 100 and 249 Employees		250 Employees or More		Total		Total
	Non-Coop	Coop	Non-Coop	Coop	Non-Coop	Coop	Non-Coop	Coop	
Ind.	148	12	83	9	44	9	275	30	305
Serv.	87	4	59	8	37	3	183	15	198
Total	235	16	142	17	81	12	458	45	503
	251		159		93		503		

maximum error of approximately 3.5%,<sup>24</sup> for a confidence level of 95% ( $p = q = 0.5$ ). Sizewise, the maximum error is situated at 5%, for firms with less than 100 employees; 6.4%, for those employing between 100 and 249; and 9%, for companies with more than 250 workers.<sup>25</sup> In the case of the cooperatives, the small size of the population means that, despite the fact that the sample covers practically half of the population, inference of results from it may incur maximum errors close to 10%.

Consequently, the definitive sample of companies that answered the survey properly is as shown in Table 6.

### 3.5. Neutralising the Influence of Factors Relating to Size, Sector and Membership of the MCC

As we indicated in the preceding section, 503 valid questionnaires were obtained from our fieldwork. Before moving on to compare the management quality of cooperative and non-cooperative companies, we tested whether the variables of *Size* and *Sector* had a significantly determining influence on replies from companies. If this were not the case, we could compare the management quality in the 458 non-Coop company sample with the Coop sample from 45 companies.

Using Chi-squared distribution contrast tests we ascertained that the points of intersection in the *Sector* factor with each question in the questionnaire, differentiating between those who apply the tool in question from those who do not, gave rise to significant differences in 14 of the 40 items considered, the distribution of the frequencies observed for some items being relatively higher than expected in favour of the industrial companies, while for others this was the case in favour of services companies.

With the *Size* factor, bivariant contrast tests also enabled us to appreciate significant differences in 20 of the 40 practices tested. In almost all the cases,

it was noted that this association increased with the size of the company, that is to say, the frequencies observed of companies applying the tool proved to be relatively higher, the greater the size of the company.

Consequently, both the *Size* and *Sector* factors have a significant influence on a great number of the dimensions comprising the Quality of Management. In these conditions, global comparison of Coops and non-Coops might lead to erroneous conclusions, since the sample obtained did not respect the same size and sector proportions between the two company groups.

To neutralise this problem, and given also that the small number of cooperatives available did not permit us to carry out a *Size–Sector* subgroup analysis, we adapted the non-Coop company sample, extracting from the sample of 458 companies a random subsample of 221 companies to fit the proportions of frequency distribution in the Coop company sample obtained.

Of the 45 cooperatives that made up our Coop sample, 30 belonged to the Mondragon group. This meant that the MCC cooperatives constituted a subgroup that doubled the rest of the Coops in size. Confronted with the possibility that membership of this group might exert a significant influence on the management quality of the cooperatives affected, we decided to neutralise this effect through an additional comparison of non-MCC and MCC Coops with the rest of the companies, taking each group separately. This way we would be able to distinguish differences in management quality arising exclusively from the fact of being a cooperative, from those deriving, where such was the case, from the influence that the MCC group might exert via its guidelines for management and/or learning and inter-cooperative example between companies in the group.<sup>26</sup>

To compare the non-cooperative companies with the Coops in the Mondragon group, another subsample of 147 companies was randomly extracted from the existing sample of 458 companies, respecting the size and sector proportions of the 30 Coops comprising MCC. Likewise, we proceeded to compare the non-cooperatives with the Coops that did not belong to MCC, via the extraction of a 206-unit subsample, adapted to the size and sector proportions of the 15 Coops in this category.

Finally, we also performed these three comparisons (non-Coops with Coops, with MCC-Coops and with non-MCC Coops) in relation to company size, for which purpose we had to exclusively neutralise the *Sector* factor (Industrial versus Services). We chose, therefore, to create a size breakdown of the non-Coop sample initially obtained (235 companies with 50–99 employees, 142 with 100–249 and 81 with more than 250 employees) and, from each of these groups, we randomly extracted subsamples which



exactly reproduced the sectoral proportions for each of the three Coop, MCC Coop and non-MCC Coop size samples, respectively.

## 4. THE DATA AND RELATED DISCUSSION

### 4.1. Behaviour of Management Quality Indicators

#### 4.1.1. Comparison of Coops/Non-Coops

With the possible influences of *Size* and *Sector* neutralised, comparison of the management performance of Basque companies results in a clear differential in favour of the cooperative companies. To be specific, this study reflects higher levels of management quality for all the indicators considered (Table 7), both globally via the Global Quality Estimator (GQE), which gives 1.12 more points in the Coops, as well as in the rest of the partial indicators in relation to the *Enablers* in the EFQM model. What stand out in particular are the results for the *Policy* criterion (a differential outcome of 1.14 points) and, above all, for the *People* criterion (differential of 1.67 points). The lowest differential, though, was found in the management of *Partnerships and Resources* (0.5 points).

It is important to note that the *People* criterion receives the lowest assessment in non-cooperatives and the second lowest in Coops. The *People* criterion, then, is the area where management is poorest in Basque companies. The *Leadership* dimension, however, is the category where companies make the most progress, being very institutionalised, particularly, in the Coops.

**Table 7.** Comparison of Cooperative and Non-Cooperative Companies.

Companies	Management Quality Indicators						N
	GQE	Leadership	People	Pol. and Str.	P'ships and Res.	Processes	
Non-Coop	6.99	8.16	5.54	6.22	6.30	7.07	221
Coop	8.11	9.30	7.21	7.68	6.80	8.25	45
Differential	1.12*	1.14*	1.67*	1.46*	0.50***	1.19*	

Note: Significant differences in one-tail *t* contrast test for:

\*  $p \leq 0.01$ .

\*\*  $p \leq 0.05$ .

\*\*\*  $p \leq 0.10$ .

**Table 8.** Comparison of Cooperative and Non-Cooperative Companies, According to Size.

No. of Companies	Management Quality Indicators						N
	GQE	Leadership	People	Pol. and Str.	P'ships and Res.	Processes	
<b>&gt; 250</b>							
Non-Coop	7.40	8.08	6.06	6.78	6.73	8.04	59
Coop	8.75	9.72	7.78	8.33	7.42	9.40	12
Differential	1.35*	1.64*	1.71*	1.55*	0.69	1.37*	
<b>100–249</b>							
Non-Coop	6.85	8.45	5.40	5.96	6.21	6.90	126
Coop	8.12	9.41	6.99	7.58	6.94	8.07	17
Differential	1.27*	0.96*	1.60*	1.62*	0.73**	1.16*	
<b>50–99</b>							
Non-Coop	6.61	7.88	4.68	5.75	5.80	6.58	197
Coop	7.61	8.85	7.01	7.29	6.19	7.59	16
Differential	1.00*	0.98**	2.33*	1.54**	0.39	1.01**	

Note: Significant differences in one-tail *t* contrast test for:

\* $p \leq 0.01$ .

\*\* $p \leq 0.05$ .

\*\*\* $p \leq 0.10$ .

If we reproduce the company size analysis, this time neutralising the *Sector* effect, we will see the sizes for which the differences are more marked. The results of this comparison, using the quality indicators mentioned, as well as the number of companies that make up the subsamples calculated, are collected in **Table 8**.

Analysis by size reveals that, globally, management quality increases proportionate to size, both in non-Coops and Coops, although the improvement is more accentuated in the latter, translating into greater differences in the GQE in the large company segment.

The management quality differentials associated with the five *Enablers* in the EFQM model exhibit disparate behaviour, which means that we are unable to draw clear conclusions regarding the data requested. We will, nevertheless, point to the behaviour of the medium to small cooperatives (50–99), as their management is substantially better than that of the non-Coops (even the larger ones) in the indicators corresponding to *People* and *Policies and Strategies*, reaching quality differentials with non-Coops of the same size at 2.33 and 1.54 points, respectively. This shows that their management, both of people and in the general strategic sense, is far more formulated and professional in relative terms.

#### 4.1.2. Comparison of MCC Coops/Non-Cooperative Companies

Reconsidering the samples used to keep the results away from the disturbances produced by the factors of *Size* and *Sector*, we can observe (Table 9) that the MCC cooperatives are managed with greater quality than the non-cooperative enterprises, both globally (GQE) and in each of the five large dimensions associated with the *Enablers* in the EFQM model. Once again, the greatest differential, by far (2.16), is to be found in the management of *People*, while the differential is less here too, in the case of the *Partnerships and Resources* dimension.

The differentials represented by the gap that exists between the management performance of MCC-Coop and non-Coop companies are greater, in all cases, than those that existed between Coop and non-Coop companies (Table 7), which tells us that, as we assumed, membership of MCC exercises a positive influence on the management quality of its attached cooperatives.

If, with the *Sector* effect neutralised, we break the companies down into differentiated groups according to the three size ranges considered in this study (Table 10), it can be observed that, as in the previous case, clear trends do not exist in entrepreneurial behaviour.

However, we can say that the smallest MCC Coop group (50–99) is also the collective where the greatest quality differential is reflected, if it is compared with similar non-cooperative companies, particularly in the management of *People* (3.16) and *Processes* (2.15). In *Policy and Strategy* and *Partnerships and Resources* the differential is greater between the companies in the intermediate group (100–249) – though here the differentials between all the sizes are very alike – while the largest

**Table 9.** Comparison of MCC Coops/Non-Cooperative Companies.

Companies	Management Quality Indicators						N
	GQE	Leadership	People	Pol. & Str.	P'ships & Res.	Processes	
Non-Coop	6.89	8.05	5.47	6.06	6.27	7.07	147
MCC Coop	8.49	9.56	7.63	7.78	7.23	8.81	30
Differential	1.60*	1.51*	2.16*	1.72*	0.97**	1.74*	

Note: Significant differences in one-tail *t* contrast test for:

\* $p \leq 0.01$ .

\*\* $p \leq 0.05$ .

\*\*\* $p \leq 0.10$ .

**Table 10.** Comparison of MCC-Coops/Non-Coops, in Accordance with Size.

No. of Companies	GQE	Leadership	People	Pol. & Str.	P'ships & Res.	Processes	N
<i>&gt; 250</i>							
Non-Coop	7.36	8.21	6.05	6.83	6.48	7.96	54
MCC Coop	8.88	9.70	7.88	8.28	7.55	9.74	11
Differential	1.52*	1.49*	1.83*	1.45*	1.06***	1.78*	
<i>100–249</i>							
Non-Coop	6.84	8.42	5.36	6.01	6.23	6.90	138
MCC Coop	8.32	9.67	7.11	7.67	7.30	7.86	10
Differential	1.47*	1.25*	1.75*	1.66*	1.07**	0.95***	
<i>50–99</i>							
Non-Coop	6.62	7.94	4.74	5.76	5.77	6.58	222
MCC Coop	8.21	9.26	7.90	7.28	6.78	8.73	9
Differential	1.59*	1.32***	3.16*	1.52**	1.01***	2.15*	

Note: Significant differences in one-tail *t* contrast test for:

\* $p \leq 0.01$ .

\*\* $p \leq 0.05$ .

\*\*\* $p \leq 0.10$ .

MCC Coops (> 250) present the most marked differential in the *Leadership* dimension.

#### 4.1.3. Comparison of Non-MCC Coops/Non-Cooperative Companies

The sample constructed for this comparison gets rid of both the influence of MCC membership, because the cooperatives in the Group are not included, and of the variables *Size and Sector*, since the company proportions in both subsamples where these two variables are concerned are similar. Consequently, this comparison is the best way of registering exclusively how a company being run cooperatively influences the management quality manifested.

So, in Table 11 we can observe that the differentials existing between the indicators referring to the management performance of non-MCC Coops as compared to non-cooperative enterprises are favourable to the non-MCC Coops. However, the differences that exist in management quality are less than those observed in previous comparisons. The two dimensions where the differences are greater are *Policy and Strategy* (1.51) and *People* (1.32). The rest of the dimensions have differentials that are clearly below 1 point.

**Table 11.** Comparison of Non-MCC Coops /Non-Cooperative Companies.

Companies	Management Quality Indicators						N
	GQE	Leadership	People	Pol. & Str.	P'ships & Res.	Processes	
Non-Coop	6.64	8.12	5.03	5.87	5.82	6.69	206
Non-MCC Coop	7.34	8.69	6.35	7.38	5.93	7.24	14
Differential	0.70***	0.57	1.32*	1.51**	0.11	0.55	

Note: Significant differences in one-tail *t* contrast test for:

\* $p \leq 0.01$ .

\*\* $p \leq 0.05$ .

\*\*\* $p \leq 0.10$ .

**Table 12.** Comparison of Non-MCC Coops/Non-Coops in Terms of Size.

No. of Companies	GQE	Leadership	People	Pol. & Str.	P'ships & Res.	Processes	N
100–249							
Non-Coop	6.69	8.28	5.31	5.86	6.07	6.69	103
Non-MCC Coop	7.83	9.05	6.83	7.46	6.43	8.37	7
Differential	1.15**	0.76***	1.52**	1.60**	0.36	1.68*	
50–99							
Non-Coop	6.58	7.81	4.59	5.78	5.75	6.54	173
Non-MCC Coop	6.84	8.33	5.87	7.30	5.43	6.12	7
Differential	0.26	0.52	1.29**	1.52	-0.32	-0.42	

Note: Significant differences in one-tail *t* contrast test for:

\* $p \leq 0.01$ .

\*\* $p \leq 0.05$ .

\*\*\* $p \leq 0.10$ .

With the *Sector* effect neutralised we now proceed to analyse the behaviour of the non-MCC cooperatives as compared with the non-Coop companies with regard to size. As we can observe in Table 12, in this case too the behaviour of the companies is disparate where size is concerned.<sup>27</sup> The GQE tells us that the global differential in management quality gets bigger as size increases. Nevertheless, in the smaller companies (50–99) the differential is favourable to the non-Coop companies in the management of *Partnerships and Resources*, as well as in the management of *Processes*. In the remaining *EFQM/Size Criterion* intersections the differentials are favourable to the non-MCC cooperatives.

#### 4.2. Behaviour of the Dimensions into Which the Elements Constituting Management Quality are Broken Down

The following table shows the results of the frequency difference contrast tests for all the items considered, in three comparisons that were carried out: (1) Cooperative Societies versus Non-Cooperatives; (2) MCC Cooperatives versus Non-Cooperatives; and (3) Non-MCC Cooperatives versus Non-Cooperatives. As in the preceding section, for each of the first and second comparisons random subsamples were produced, the purpose being to equalise the frequency distributions of the non-cooperatives with reference to *Size* and *Sector* with the distribution of the Coops (45 altogether) and of the MCC Coops (a total of 30), respectively.

In the case of the third group, the non-MCC cooperatives, since there are only 15 companies, there are not enough for them to be shared out simultaneously according to *Size* and *Sector*. Due to this, the equivalence of proportions in relation to non-cooperatives was made with reference only to *Size*.

Each of the three last columns in Table 13 shows the results of the contrast tests with the Chi-squared ( $\chi^2$ ) distribution determining whether an association exists between the fact that a practice/management tool is utilised (that is to say, the item in question has been answered affirmatively) and the fact that a company belongs to one group or another.<sup>28</sup>

In the first comparison, between Coops and non-Coops, it is confirmed that there is an association between the juridical status of the society and the favourable response in 20 of the 40 dimensions or practices/management tools analysed. In all these cases, the frequencies are significantly greater for the cooperative companies.

The Coops stand out clearly from other kinds of societies in management performance related to the dimensions where the following variables are broken down: *Shared Leadership (Leadership)*, *Internal communication and social audit (People Management)*, *Customer and Market Orientation (Process Management)* and *Technification of Strategic Management (Policy and Strategy)*.

Likewise, they also have advantages in specific management dimensions such as: "Participation in Training Actions" (*People Management*), "Implementation of Variable Salaries" (*People Management*), "Benchmarking Practice" (*Policy and Strategy*), "Register of Suppliers", "Agreements to Share Resources" and "Knowledge Management" (*Partnerships and Resources*).

These results are, to a good degree, concordant with the hypotheses of behaviour that we had established. In other words, cooperatives ought to

**Table 13.** Behaviour of the Dimensions into which the Criteria and Variables in the EFQM Model are Broken Down.

Key EFQM Criteria	Variables to Consider	Dimensions into which the Variables are Broken Down	Coops vs. Non-Coops	MCC Coops vs. Non-Coops	Non-MCC Coops vs. Non-Coops
Leadership	Commitment to improvement	Training in management techniques			
		Conscious transmission of values			
	Shared leadership	Active encouragement of improvement projects			
		Shared establishment of objectives and strategies	Coops <sup>a,*</sup>		
People management	Training and development	Objectives and strategies known by the whole company	Coops <sup>**</sup>	Coops MCC <sup>**</sup>	
		Teamwork with decision-making powers	Coops <sup>***</sup>		
		Identification of desired profiles			
		Existence of training plans			
	Compensation policy	Participation in training actions <sup>b</sup>	Coops <sup>**</sup>	Coops MCC <sup>**</sup>	
		Managers with variable salaries		Coops MCC <sup>*</sup>	
		Workers with variable salaries	Coops <sup>**</sup>	Coops MCC <sup>**</sup>	
	Internal communication and social audit	Use of non-salaried systems of compensation			
		Internal communication plan	Coops <sup>**</sup>	Coops MCC <sup>**</sup>	
		Panel of social indicators	Coops <sup>**</sup>	Coops MCC <sup>*</sup>	Coops. No MCC <sup>**</sup>
	Surveys and interviews with workers	Coops <sup>**</sup>	Coops MCC <sup>**</sup>	Coops. No MCC <sup>**</sup>	

Policy and strategy	Technification of strategic management	DAFO diagnosis	Copos**			
		Document with objectives and strategies	Coops*	Coops MCC <sup>a,*</sup>		
		Strategy/Structure adaptation	Coops**	Coops MCC*	Coops. No MCC***	
		Panel of objective and management indicators		Coops MCC <sup>a,***</sup>		
		Analysis of profitability of products and clients				
		EFQM or similar self-assessment	Coops**	Coops MCC**		
Partnerships and resources	Capture of relevant external information	Benchmarking	Coops*	Coops MCC*		
		File of competitors according to competitive profile				
		Register of suppliers	Coops***	Coops MCC*		
Partnerships and resources	List of external collaborators	Collaboration with suppliers	Coops**	Coops MCC**		
		Agreements to share resources				
		Social action in connection with the community				
	Internal resources	Internal resources	Computerised treasury management system			
			Internet in commercial relations		Coops MCC***	
			Application of "5 s" technique			
Processes	Internal process management	Insurance for commercial operations		Coops MCC**		
		Knowledge management	Coops*	Coops MCC*		
		External accreditation (ISO and others)		Coops MCC <sup>a,***</sup>		
	Customer and market orientation	Customer and market orientation	Review and process improvement systems		Coops MCC***	
			Customer need detection systems	Coops*	Coops MCC*	



*Table 13. (Continued)*

Key EFQM Criteria	Variables to Consider	Dimensions into which the Variables are Broken Down	Coops vs. Non-Coops	MCC Coops vs. Non-Coops	Non-MCC Coops vs. Non-Coops
		System for measuring degree of customer satisfaction	Coops*	Coops MCC**	
		Complaints and claims management system	Coops*	Coops MCC <sup>a,**</sup>	
		Customer performance indicators	Coops*	Coops MCC***	
		Periodic execution of market studies		Coops MCC*	
		In-house dissemination of information concerning customers			

*Note:* Significant differences in two-dimensional table Chi-squared test for:

\*  $p \leq 0.05$ .

\*\*  $p \leq 0.01$ .

\*\*\*  $p \leq 0.10$ .

<sup>a</sup>Expected frequency lower than 5 in a box.

<sup>b</sup>Proportion of staff who have participated in training actions during the last year. Two alternatives: Lower or higher than 25%.

distinguish themselves in carrying out certain management practices related to the development of cooperative principles, such as: the following.

- Those relating to *shared leadership*, in whose three dimensions (shared setting of objectives and strategies, objectives and strategies known to all in the company, teamwork with decision-making power) they stand out against non-cooperative companies, exhibiting significantly differentiated behaviour.
- Those relating to *training and development*, where they demonstrate greater worker participation in training actions. Nevertheless, the results of our research do not demonstrate significantly differentiated behaviour in relation to the establishment of diagnoses of training needs, nor in the existence of training schemes.
- Those relating to activities of *communication and social audit*. In the three dimensions into which the variable is broken down (internal communication plan, panel of social indicators, surveys and interviews with workers) they show a significantly differentiated and active behaviour compared with non-cooperative companies.
- Those relating to the establishment of *partnerships with outside collaborators*, where they demonstrate significantly differentiated behaviour in the dimension of partnerships for sharing resources, while in dimensions of collaboration with suppliers and social activity related to the community they do not.

In the second comparison carried out, in relation to MCC cooperatives and non-cooperative societies, we find confirmation of association with a positive answer in favour of the former in 24 of the 40 dimensions analysed. The MCC cooperatives stand out clearly for management performance in two of the five big criteria in the EFQM model; i.e. *People* and *Policy and Strategy*. In addition, they demonstrate greater quality of management for the following variables: *Internal Process Management*, *Customer and Market Orientation (Process Management)*, as well as *Internal Resources and Relations with External Collaborators (Management of Partnerships and Resources)*. Finally, they stand out from the rest of the companies in management of the dimension: “Shared Knowledge of Objectives and Strategies” (*Leadership*).

Lastly, the third comparison, carried out between non-MCC cooperatives and non-cooperative societies, confirms that there are differences centring exclusively on two aspects of the variable *Internal communication and social audit (People management)*, such as: the “Existence of a social indicators panel” and “Holding interviews and carrying out surveys with workers”,

and on one feature of the variable *Technification of Strategic Management (Policy and Strategy)*: “Strategy/Structure adaptation”.<sup>29</sup> However, neither in Leadership practices, nor in those of Training and Development, nor in those relating to Outside Collaborators do they show significantly differentiated behaviour.

## 5. SUMMARY AND CONCLUSIONS

In this study we set out to measure and assess the quality of management performance of Basque companies in the industrial and company services sectors, comparing the behaviour of cooperative companies, a group with specific differentiated characteristics that is amply represented in the sectors we chose, with that of the non-cooperatives. To do so, we used the EFQM model of business excellence as a conceptual and instrumental medium. Models such as the EFQM (or, where appropriate, the Malcolm Baldrige model) systematise and articulate the array of principles, techniques, tools and even language, in complete models of business understanding and management that represent what Total Quality Management (TQM) is ideally all about.

The choice of the EFQM model as a support for this research was for two fundamental reasons: (a) on the one hand, apart from the fact that there has not been a definitive resolution of the debate as to which dimensions effectively define quality management, the EFQM presents a set of management criteria, variables and dimensions that are widely accepted and recognised by the entrepreneurial world and have great potential use as an instrument for comparing companies; (b) on the other hand, this model has been generously disseminated within the European ambit and, very particularly, in the Basque Country, where the Administrations have decidedly plumped for it (to a point where it has become an unquestionable, and unique referent for TQM). This, consequently, facilitated acceptance and understanding of our questionnaire among the companies consulted.

Comparison of the management performance of Basque companies throws up a clear differential in favour of cooperative companies. That is to say, this study reflects higher degrees of management quality in all the indicators considered at a global level. Likewise, they show significant differences in half of the management practices that make up the *Agent Criteria* of the EFQM model (20 out of a total of 40). Among these, the behaviour of the cooperatives stands out particularly in: *Shared Leadership*,

*Internal Communication and Social Audit, Technification of Strategic Management and Customer and Market Orientation.*

Analysis by size reveals that, globally, management quality improves in direct relation to company size, both in non-Coop and Coop companies, although the improvement is more marked in the latter group.

Breaking down the Coop sample into members and non-members of the Mondragon Group shows the powerful influence this group exerts on the global results for Coops.

The non-MCC cooperatives present significantly better results than the non-cooperative companies in only 3 of the 40 items analysed, these being related to the *information and social responsibility* inherent in cooperative companies due to their specific set up based on worker-associates, and to the greater *organisational flexibility* that these organisations seem to demonstrate. These three aspects are, therefore, the only ones in which, in the light of our analysis, there is significant differentiation in the management of cooperative and non-cooperative companies, after neutralising the influence that size, sector and, above all, membership of the MCC group exercise on Basque company management quality.

Membership of the MCC group exerts a powerful influence on the quality of management in Basque cooperatives. The gap that exists between management performance in the MCC cooperatives and non-cooperative companies is greater, in all cases, than that which exists between cooperative companies, in general, and the non-cooperatives. Management quality in the MCC cooperatives is significantly higher than that of the rest of the companies, cooperative and non-cooperative, in 24 of the 40 practices analysed, with particularly outstanding results in *People Management, Technification of strategic management and Processes*.

Consequently, the cooperative principles of education, intercooperation and, partially, of democratic organisation do not seem to exercise a sufficient influence on Basque cooperatives that are not members of the MCC group that would differentiate their management from that of non-cooperative companies in the main aspects of management deriving from them: training and development, relations with outside agents and shared leadership. They do, however, exhibit significant superiority in some aspects relating to the right to information and participation, stemming from the principle of democratic organisation, these being principles that, in our study, translate into better internal communication and a greater emphasis on the evaluation of social results.

Nevertheless, in MCC group cooperatives, in general, management practices analysed that are directly related to the cooperative principles

considered *do* show a performance that is significantly superior to that of the non-cooperative companies. This might be explained by the fact that a greater cooperative awareness is cultivated within the group.

Nonetheless, as a clear superiority is exhibited in other management practices that are, in principle, not associated with these principles, this would indicate that there must, in addition, exist other explanatory causes.

In this sense, the superiority, in general, in the management of MCC cooperatives may have different origins.

One explanation may actually reside in the fact that it is a united entrepreneurial group, with a common directorship that itself proposes homogeneous management practices that have been tried out in the different cooperatives and transmitted to them all via the vehicles of communication, training and executive management the group has at its disposal. Knowledge in Management is, therefore, a strategic knowledge that is transferred from the person who possesses it to the person who does not possess it, improving the competitiveness of the group as a whole. Suitable management of executive knowledge would, in short, seem to be the main cause of the superiority observed.

This reasoning is reinforced by the fact that the positive influence that accrues from membership of the MCC group manifests itself to a greater degree when company size is smaller. Consequently, this may indicate that this kind of company benefits most, in relative terms, from membership of a grouping that guides them in the adoption of recommendable management practices and helps them to relate to and learn from other fellow group member cooperatives of different sizes. Inter-business grouping and collaboration are revealed, in the management sphere as well, to be a valuable option for small companies to overcome the weaknesses inherent in their size.

To the circumstances mentioned above must be added the fact that history has shown that good management moves (strong strategic orientation, appropriate cooperation and management of people between cooperatives, financial management supervised and supported by the group's financing entity, etc.) have proved fundamental for tackling the different crises that the western economies have undergone over the last 30 years and for emerging from them with new strength, which is why the group is generally sharply attentive when it comes to quality of management. It is aware of its importance as an instrument for survival and for competitiveness and that it can, in a certain sense, compensate for other weaknesses manifested by cooperatives when compared to other juridical forms (financial, less attractive retributions to executives, juridical difficulties for growth, etc.). This

experience, conveniently transmitted to all the cooperatives in the group, can also explain their executive advantage over non-cooperatives and non-MCC cooperatives. In a way, integration within a group like the MCC has become a mechanism of survival for the majority of Basque cooperatives, thanks to the better quality of management, strategic orientation, financial robustness, political force etc. that they are able to achieve and with which they can face market challenges, without renouncing their cooperative character. The present shape of the MCC group today can be considered to be the product of a process of progressive adaptation through the selection of the best options available at each moment, with the purpose of guaranteeing survival within an increasingly competitive environment. From a perspective of natural selection, the theory of Ecology of Organisations<sup>30</sup> (Hannan & Freeman, 1977; Aldrich, 1979) is useful for understanding this approach.

Finally, an alternative explanation, complementary to that just given, can be found in the fact that the group's leadership also adopted the EFQM model as a principal referent for management, whereby greater knowledge and relative application of the same model within the group may have contributed to better results in the evaluation of its management quality, showing a superiority that, perhaps, is not totally real, but that can be partly explained by the model and measurement criteria that we used for its assessment. The Institutional Theory<sup>31</sup> (Meyer & Rowan, 1977; DiMaggio & Powell, 1983) illustrates this argument. This superiority in management, therefore, along with other reasons of a more cultural and sociological origin, which are not the subject of this study, may explain the permanence and development of a group with these characteristics – integrated by a fairly unusual type of company within the national and international cooperative world (mainly industrial companies whose average size is larger than that of the companies within its geographic ambit of reference) – that competes successfully in increasingly globalised markets, does not respond to criteria of juridical status, but to those of efficiency and efficacy, and where being large enough is in turn an ever more necessary condition for entrepreneurial competitiveness.

## **6. LIMITATIONS AND FUTURE LINES OF RESEARCH**

It is very difficult to obtain rich, real information from a sample with numerous managers. In this study we opted to circumscribe our work to a specific territorial ambit, the Autonomous Community of the Basque

Country, in order to operate with a homogeneous company sample, in cultural and political terms, comprising Coops and non-Coops. This limited the number of replies in the Coops and stopped us carrying out more profound analyses to isolate the effect of potentially important factors such as technological intensity, the length of time the company has been in operation, industrial subsectors, and others that might have an influence on the quality of management.

In the future, new empirical research operations will have to be undertaken, with greater cooperative samples, to make it possible to determine the net influence of the cooperative juridical status in management quality, in isolation from other potentially influencing factors, as well as to compare different geographical contexts.

Another interesting line of research also opens up, that of relating these cooperative and non-cooperative management quality levels to the business results obtained in the social and economic fields.

Finally, we wish to indicate that, while the conclusions presented constitute a faithful reflection of the data obtained in this study, it is likely that the real management quality of the smaller companies, both Coop and non-Coop, is more positive than what these statistics show, since they refer, in the main, to the formal quality of management, “formality” being a value that loses its importance as the size of a company decreases. The data obtained do not record with precision aspects such as the degree to which managers and employees are motivated and involved in the company, strategic positioning, customer proximity and service, product and service flexibility, and other aspects that are quite definitely very present in many small and medium-sized companies and that lend these companies a competitiveness plus factor which does not show up in the results as set out here.

## NOTES

1. Entrepreneurial competitiveness or competitive success could be conceived, in line with the views expressed on this subject by various authors (cf. Cuervo, 1993; Bueno, 1995; Álvarez & García, 1996; Camisón, 1997; Rubio & Aragón, 2002), to be the ability of a company, in rivalry with others in an open and increasingly demanding market, to secure a favourable position, maintain and increase its participation and obtain better results without resorting to an abnormally low rate of remuneration for the factors of production.

2. Formalising the Resource and Capacities Theory was a slow interrupted process, which took its starting point from the Resources Theory of Penrose (1959)

and Andrews (1971), and gradually reached its definitive realisation in the work of authors such as: Wernerfelt (1984); Teece (1982, 1986); Ouchi (1981); Grant (1991); and Hamel and Prahalad (1994).

3. For a company's resources and capacities to function as distinctive competences, they must conform to a series of characteristics (Amit & Schoemaker, 1993): they must be lasting, of limited resources, mutually complementary in the value-generating process, difficult to transfer, inimitable, difficult to replace and must mesh with strategic sector factors.

4. The same does not occur in the sphere of quality management research, where there is a much more firmly rooted scientific tradition.

5. This study is the product of collaboration between Confebask (Basque Business Confederation) and a research team from the Institute of Applied Business Economics of the University of the Basque Country. This collaboration went ahead under the auspices of a University of the Basque Country programme under the heading "University-Company Research Projects" (Type 1), begun in 2001.

6. The Basque Country is an important Autonomous Community in Spain. It has over two million inhabitants and has great relevance in the country, in both economic and cultural terms. Its GDP makes up 6.15% of the national total and its main city is Bilbao.

7. Statistics from 2003. [www.ine.es](http://www.ine.es).

8. Statistics from 2003. [www.ine.es](http://www.ine.es) and [www.eustat.es](http://www.eustat.es).

9. In accordance with the Commission of the European Communities (2001): (a) adoption of decisions following the principle of "one member, one vote"; (b) equitable contribution to members' net worth; (c) restricted distribution of benefits, which is generally proportional to the use of the cooperative's services; (d) the accumulation of assets is not reflected in the value of the shares; (e) shares cannot be the subject of transactions in the value market; (f) freedom to enter and leave the cooperative; (g) the nominal capital is variable; and, (g) in liquidation operations what prevails is the principle of non-distribution (or limited distribution).

10. These ideas and others of a more ideological-political content took shape in the Basic Principles formulated by the pioneers of the modern cooperative movement – the Rochdale weavers, in 1844 – in the statutes of the cooperative, the Rochdale Society of Equitable Pioneers, which were updated later in 1937 and 1966 at the congresses of the International Co-operative Alliance (ICA).

11. These cooperative principles are available on the ICA website at <http://www.coop.org/coop/principles.html>

12. This argument meshes with the debate on the sources of company competitiveness. In different studies regarding this question, carried out at an international level (Gort & Singamsetti, 1976; Schmalensee, 1985; Wernerfelt & Montgomery, 1988; Hansen & Wernerfelt, 1989; Rumelt, 1991; Montgomery & Wernerfelt, 1991; Galán & Vecino, 1997; Fernández, Montes, & Vázquez, 1996, 1999), it is reliably demonstrated that the "industry effect" – i.e., that the principal determinant of a company's profitability derives from the industrial sector it belongs to – has a significantly lower impact than the "company effect" – or, to put it another way, that the competitive advantage of the company can rest on its distinguishing internal features when we want to explain the differences that are registered in the profitability of companies, and that the differences in profitability that exist between them



are greater among firms that are in the same sector than among those that belong to different sectors. These studies, that is, enable us to affirm that the specific characteristics of cooperatives can produce a favourable impact on their performance.

13. Compare, for example, the allusion to the importance of training in the Mondragon experience and the small value assigned by research to the latter (Meek & Woodworth, 1990).

14. Arizmendiarreta (2002): "Core Ideas From Mondragon's Founder", *Social Policy – 'Special Feature: Mondragon Cooperatives'* (Winter 2001/2002), p. 10–11. (Posthumous) extract from Arizmendiarreta's thoughts on the Mondragon cooperative experience.

15. Father Arizmendiarreta based himself on certain principles of Catholic doctrine, on his familiarity with the work of Robert Owen, one of the first philanthropists of the industrial era, and on the statutes (drawn up in 1884) of the consumer cooperative – the Rochdale Society of Equitable Pioneers, the first successful cooperative experience in the United Kingdom (Bradley & Gelb, 1981).

16. On this question, there is a debate between those who believe that the growth and internationalisation of the group is leading to a distancing from their core social principles (Moye, 1993) and those who believe that the group possesses sufficient ideas and resources to stay true to these commitments without renouncing its objectives of growth and profitability (Cheney, 2001; Taylor, 1994; Urdangarin, 1999).

17. With regard to training, see the Otorora training centre, for managers in the Group; incentives for the complete professional training of the workers, with the aim of encouraging mobility between cooperatives and job positions; or, in relation to activities of communication, the journal *T.U. Lankide*.

18. See: European Foundation for Quality Management, <http://www.efqm.org>.

19. It must be noted that application of the EFQM model in the Basque Country has become an official commitment for the Basque Administration in the area of total quality management models, support being given to development of the model in companies via different initiatives. In parallel, Basque companies occupy an important position within the European group of European Quality Award-winning companies. Spain is the country with the highest number of companies recognised in the EQA (19), the majority of them (10) being from the Basque Country (5 winners and 5 finalists) Source: *Euskalit*. <http://www.euskalit.net>.

20. In particular, the original scale differentiated the following levels of response: 0 = NO; 1 = YES: "We are implementing it at the moment"; 2 = YES: "We implemented it during the course of last year"; 3 = YES: "We have been doing it for the last 1–3 years"; 4 = YES: "We have been doing it for the last 4–5 years"; 5 = YES: "We have been doing it for more than 5 years".

21. The weighting coefficients for each criterion were assigned considering exclusively the 500 points that the EFQM gives to Enablers and the relative weight of each criterion within the same 500 points.

22. From other sources we know that this sample framework does not correspond exactly to cooperative reality. Eustat data, for instance, confirmed to us that, in 2003, this population constituted 128 cooperatives, but as we had no access to the names and addresses of those Coops we decided to take as our sample framework the 93 cooperatives appearing in Duns.

23. The fundamental reason that led us to choose this approach route to managers was that we wished to guarantee the highest response index possible, since the size of the sample that we wanted to work on was very large in proportion to the total group of companies. Telephone interviews, due to the limited time involved and the direct access to interviewees it provides, is particularly useful for gaining access to groups such as top-line managers, who do not dispose of much time and are, therefore, little inclined to spend it filling in questionnaires or sitting through person-to-person interviews (Brand, 1984, p. 45; Reeder et al., 1991, p. 174).

24. For a proportional sampling procedure, the confidence interval for  $\hat{p}_e$  is  $\hat{p}_e \pm Z_{\alpha/2} \sqrt{\text{Var}(\hat{p}_e)}$ , and the variance  $\text{Var}(\hat{p}_e)$  is:

$$\text{Var}(\hat{p}_e) = \sum_{i=1}^3 \left( \frac{N_i}{N} \right) \left( 1 - \frac{n_i}{N_i} \right) \frac{\hat{p}_i(1 - \hat{p}_i)}{n_i - 1}$$

25. Applying a simple random sampling procedure for each stratum.

26. The research team was aware that this influence existed, both through official communication from MCC itself and via personal acquaintance with the management practices of numerous Coops within the group, though we were unaware of how intense the phenomenon was in terms of management practices that are actually adopted in reality and the relative difference this represents when compared with the practices of other non-MCC cooperatives.

27. As there only exists one non-MCC cooperative company with more than 249 employees, there is no room for comparisons that allow general conclusions to be drawn.

28. The crossed table Chi-squared distribution contrast test makes it possible to determine whether two ordinal or nominal variables are mutually associated. It involves determining the squared differences between the frequencies observed in the intersections of the boxes in the resulting table, and the expected frequencies via a ratio. Supposing that it follows a Chi-squared distribution for the same degrees of freedom, the size of the study determines the degree of probability (significance level) that would be expected if there were no association between the variables for any random sample taken. A condition required for this test is that the expected frequencies be greater than 5 in all the boxes. Should this condition not be met, it would then be recommendable for there to be a regrouping of one of the variables (or both) at a lower number of levels. For a more detailed explanation of this contrast test, see Ruiz-Maya and Martín (1995, pp. 604–614).

29. This dimension was measured in relation to the response to the following: “We have reviewed and/or designed our new organisational structure (i.e., departments, posts, functions, responsibilities...) in accordance with our targets and strategies”.

30. The theory of the Ecology of Organisations, based on models taken from natural selection in ecology and biology, states that, when surrounding resources are limited and distributed in the shape of niches, the only organisations that survive are the ones that select the right means of adapting to them, eventually providing the opportunity for the creation of a set of homogeneous survivor organisations.

31. The Institutional Theory’s proposition is that organisations not only operate exclusively in search of internal efficiency, but also try to obtain external legitimacy, and thus increase their possibilities of survival, which is why they tend to adopt the

same practices, organisational designs, etc. (in our case, the EFQM model) as other organisations do (all the other MCC cooperatives) in order to be accepted and valued, regardless of whether they are or are not the best.

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## REFERENCES

- Abell, P. (1985). Industrial democracy, has it a future? The West European experience. *Journal of General Management*, 10(4, Summer), 50–63.
- Agirre, A. (2001). Los principios cooperativos “atractores” de la gestión eficiente: su medición. *Aplicación al caso de Mondragón Corporación Cooperativa, CIRIEC*, 39, 93–113.
- Albizu, E., & Basterretxea, I. (1998). Flexibilidad laboral y generación de empleo en tiempos de crisis. El caso Mondragón Corporación Cooperativa. *Revista Europea de Dirección y Economía de la Empresa*, 7(3), 83–98.
- Aldrich, H. (1979). *Organizations and environments*. New Jersey: Prentice-Hall.
- Álvarez, J. C., & García, E. (1996). Factores de éxito y riesgo en la Pyme: Diseño e implantación de un modelo para la mejora de la competitividad. *Economía Industrial*, 310, 149–161.
- Amit, R., & Schoemaker, P. J. H. (1993). Strategic assets and organizational Rent. *Strategic Management Journal*, 14, 33–46.
- Andrews, K. R. (1971). *The concept of corporate Strategy*. New York: Down Jones-Irwin.
- Aranzadi, D. (2000). Ética de la empresa y cooperativismo (segunda parte). *Estudios Empresariales*, 103, 12–18.
- Arizmendiarreta, J. M. (2002). Core Ideas From Mondragon’s Founder, Social Policy – ‘Special Feature: Mondragon Cooperatives’ (Winter 2001/2002), pp. 10–11.
- Azurmendi, J. (1992). *El hombre cooperativo. Pensamiento de Arizmendiarreta*. Mondragón: Otalora.
- Bager, T. (1994). Isomorphic processes and the transformation of cooperatives. *Annals of Public and Cooperative Economics*, 65(1), 35–57.
- Barton, D. (1989). What is a cooperative? In: D. Cobia (Ed.), *Cooperatives in agriculture* (pp. 1–21). Englewood Cliffs: Prentice-Hall.
- Belley, M. (1988). Les relations entre économie sociale, économie publique et économie privée. La dérive des coopératives au Québec. In *Les systèmes d’économie mixte dans les économies modernes. Actes du XV Congrès du CIRIEC*. Uège, pp. 131–141.
- Bradley, K., & Gelb, A. (1981). *Obstacles to a cooperative economy: Lessons from Mondragon*. London: London School of Economics and Political Science.
- Brand, G. T. (1984). Industrial marketing research. In: N. A. Hart (Ed.), *The marketing of industrial products*. New York: Wiley.

- Bueno, E. (1995). La competitividad en la empresa: un enfoque de “organización” y una referencia a España. *Dirección y Organización*, 13, 5–15.
- Camisón, C. (1997). *La Competitividad de la PYME Industrial Española: Estrategia y Competencias distintivas*. Madrid: Cívitas.
- Chaves, R. (1997). Economía política de la Economía Social. *CIRIEC*, 25, 141–162.
- Cheney, G. (2001). Forms of connection and ‘severance’ in and around the Mondragon worker-cooperative complex. In: G. J. Shepherd & E. W. Rothernbuhler (Eds), *Communication and community* (pp. 135–156). Mahwah: Lawrence Erlbaum.
- Commission of the European Communities (2001). *Las cooperativas en la Europa de las empresas*. Brussels.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, 297–334.
- Cropp, R., & Ingalsbe, G. (1989). Structure and scope of agricultural cooperatives. In: D. Cobia (Ed.), *Cooperatives in agriculture* (pp. 35–67). Englewood Cliffs, CA: Prentice-Hall.
- Cuervo, A. (1993). El papel de la empresa en la competitividad. *Papeles de Economía Española*, 56, 363–378.
- Davis, P. (1999). *Managing the cooperative difference: A survey of the application of modern management practices in the cooperative context*. Geneva: International Labour Office.
- DiMaggio, P., & Powell, W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 48, 147–160.
- Euskal Estadística Erakundea/Instituto Vasco de Estadística (Eustat). (2003). Statistics on total employment in the Basque Autonomous Community. <http://www.eustat.es>
- Fernández, J. (2006). Structural changes in the development of European co-operative societies. *Annals of Public and Cooperative Economics*, 77(1), 107–127.
- Fernández, E., Montes, J. M., & Vázquez, C. J. (1996). Efecto industria y conducta empresarial. *Revista Europea de Dirección y Economía de la Empresa*, 5(2), 149–158.
- Fernández, E., Montes, J. M., & Vázquez, C. J. (1999). Las fuentes de creación de valor en la empresa. *Boletín de Estudios Económicos*, LIV(166), 95–120.
- Forcadell, F. J. (2000). Success in the practical application of cooperative principles at Spain’s Mondragón Cooperative Corporation. *National Productivity Review*, 19(3 (Summer)), 59–71.
- Galán, J.L., & Vecino, J. (1997). Las fuentes de rentabilidad de las empresas. *Revista Europea de Dirección y Economía de la Empresa*, 6(1), 21–36.
- García-Gutiérrez, F. C. (1994). La concentración económico-empresarial de sociedades cooperativas, in AAVV, *Las empresas públicas sociales y cooperativas en la nueva Europa*. XIX Congreso Internacional de CIRIEC. Valencia: CIRIEC, pp. 419–442.
- Gentzoglani, A. (1997). Economic and financial performance of cooperatives and investor-owner firms: An empirical study. In: J. Nilsson & G. Van Dijk (Eds), *Strategies and structures in the agro-food industries* (pp. 171–182). Van Gorcum: Assen.
- Gort, M., & Singamsetti, R. (1976). Concentration and profit rates: New evidence and old issue. *Explorations in Economic Research*, 3(winter), 1–20.
- Grant, R. M. (1991). The resource based theory of competitive advantage: Implications for strategy formulation. *California Management Review*, 33(3), 114–135.
- Greenberg, E. S. (1980). Participation in industrial decision-making and work satisfaction. *Social Science Quarterly*, 60, 551–568.

- Hamel, G., & Prahalad, C. K. (1994). *Competing for de future*. Cambridge: Harvard-Business School Press.
- Hannan, M. T., & Freeman, J. (1977). The population ecology of the organizations. *American Journal of Sociology*, *83*, 929–984.
- Hansen, G., & Wernerfelt, B. (1989). Determinants of firm performance: The relative importance of economic and organizational factors. *Strategic Management Journal*, *10*, 399–411.
- Helmberger, P., & Hoos, S. (1964). Cooperatives, enterprise and organization theory. *Journal of Farm Economics*, *44*, 275–290.
- ICA-International Co-operative Alliance (1998), ICA Statistics. Geneva. <http://www.coop.org/statistics.html>.
- Katz, J., & Boland, M. A. (2002). One for all and all for one? A new generation of co-operatives emerges. *Long Range Planning*, *35*, 73–89.
- Long, R. J. (1978a). The effects of the employee ownership on organizational identification, employee job attitudes, and organizational performance: A tentative framework and empirical findings. *Human Relations*, *31*, 29–49.
- Long, R. J. (1978b). The relative effects of share ownership vs. control on job attitudes in an employee-owned company. *Human Relations*, *31*, 753–763.
- Meek, C. B., & Woodworth, W. P. (1990). Technical training and enterprise: Mondragon's educational system and its implications for the cooperatives. *Economic and Industrial Democracy*, *11*, 508–528.
- Meyer, J., & Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. *American Journal of Sociology*, *83*, 340–363.
- Ministerio de Trabajo y Asuntos Sociales (2003). Coyuntura Laboral. Análisis del Mercado de Trabajo 67, dic. <http://www.mtas.es/empleo/coyuntura/default.htm>.
- Mollner, T. (1994). Mondragon: Archetype of future business? *Bulletin of Science, Technology & Society*, *14*(2), 83–87.
- Molyneux, P. (2005). The productivity of European co-operative banks. *Managerial Finance*, *31*(11), 26–35.
- Mondragón Corporación Cooperativa, (2005). Informe Anual 2004, May. <http://www.mcc.coop/esp/magnitudes/memoria.html>.
- Montgomery, C. A., & Wernerfelt, B. (1991). Sources of superior performance: Market share versus industry effects in the US brewing industry. *Management Science*, *37*(8), 954–958.
- Moye, A. M. (1993). Mondragón: Adapting co-operative structures to meet the demands of a changing environment. *Economic and Industrial Democracy*, *14*, 251–276.
- Navarro, M., & Buesa, M. (2004). *Sistema de Innovación y competitividad en el País Vasco*. Donostia-San Sebastian: Eusko Ikaskuntza.
- Nunnally, J. C. (1978). *Psychometric theory* (2nd ed). New York: McGraw Hill
- Ouchi, W. G. (1981). *Theory Z: How American business can meet the Japanese challenge*. Reading, MA: Addison-Wesley.
- Penrose, E. (1959). *The theory of the growth of the firm*. New York: Wiley.
- Reeder, R. R., Brierty, E. G., & Reeder, B. H. (1991). *Industrial marketing: Analysis, planning and control*. Englewoods Cliffs, CA: Prentice-Hall.
- Rhodes, S. R., & Steers, R. M. (1981). Conventional vs. worker-owned organizations. *Human Relations*, *34*(12), 1013–1035.

- Rooney, P. M. (1992). ESOPS, producer co-ops, and traditional firms: Are they different? *Journal of Economic Issues*, 26(2, June), 593–694.
- Rubio, A., & Aragón, A. (2002). Factores explicativos del éxito competitivo. Un estudio empírico en la pyme. *Cuadernos de Gestión*, 2(1), 49–63.
- Ruiz-Carrillo, J. I. C., & Fernández, R. (2005). Theoretical foundation of the EFQM model: The resource-based view. *Total Quality Management*, 16(1), 31–55.
- Ruiz-Maya, L., & Martín, F. J. (1995). *Estadística II: Inferencia*. Madrid: Editorial AC.
- Rumelt, R. P. (1991). How much does industry matter? *Strategic Management Journal*, 12, 167–185.
- Russell, R., Hochner, A., & Perry, S. E. (1979). Participation, influence, and worker ownership. *Industrial Relations*, 18, 330–341.
- Schmalensee, R. (1985). Do markets differ much? *American Economic Review*, 75(3, June), 341–351.
- Sexton, R. J., & Iskow, J. (1993). The competitive role of cooperatives in market-oriented economies: A policy analysis. In: C. Csaki & Y. Kislev (Eds), *Agricultural cooperatives in transition* (pp. 55–84). Boulder: Westview Press.
- Spear, R. (2000). The cooperative advantage. *Annals of Public and Cooperative Economics*, 71(4), 507–523.
- Taylor, P. L. (1994). The rhetorical construction of efficiency: Restructuring and industrial democracy in Mondragón, Spain. *Sociological Forum*, 9(3), 459–489.
- Teece, D. (1982). Towards an economic theory of the multiproduct firm. *Journal of Economic Behaviour and Organization*, 3, 39–63.
- Teece, D. (1986). Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research Policy*, 15(December), 285–305.
- Thomas, H., & Logan, C. (1982). *Mondragon: An economic analysis*. London: George Allen and Unwin.
- Urdangarín, C. (1999). Interpretación de Mondragón Corporación Cooperativa. *Ekonomia*, 44, 239–255.
- Van Bekkum, O. F., & Van Dijk, G. (Eds) (1997). *Agricultural cooperatives in the European Union: Trends and issues on the eve of the 21st century*. Assen: Van Gorcum.
- Van de Den, A., & Ferry, D. (1979). *Measuring and assessing organizations*. New York: Wiley.
- Vargas, A. (1995). La identidad cooperativa y la cooperativa como empresa: luces y sombras. *Revista de Estudios Cooperativos (REVESCO)*, 61, 179–192.
- Vargas, A. (1999a). Claves de la excelencia en la gestión de sociedades cooperativas. In: J. A. Prieto Juárez (Coord), *Sociedades cooperativas: Régimen jurídico y gestión económica* (pp. 285–303). Madrid, *Ibidem*.
- Vargas, A. (1999b). De la participación en la empresa a la empresa de participación democrática. *Revista de Estudios Cooperativos (REVESCO)*, 67, 219–234.
- Vivet, D., & Thiry, B. (2000). Campo de estudio, importancia cuantitativa y acepciones nacionales. In: R. Chaves, D. Demoustier & J. L. Monzón (Dirs.), *Economía Social y Empleo en la Unión Europea*. Acción Piloto, Tercer Sistema y Empleo de la Comisión Europea, Valencia, CIRIEC.
- Wernerfelt, B. (1984). A Resource-based view of the firm. *Strategic Management Journal*, 5, 171–180.
- Wernerfelt, B., & Montgomery, C. A. (1988). Tobin's Q and the importance of focus in firm performance. *American Economic Review*, 78(March), 246–250.

- Whyte, W. F. (1995). Learning from the Mondragón cooperative experience. *Studies in Comparative International Development*, 30(2 Summer), 58–67.
- Whyte, W. F., & Whyte, K. L. (1996). *Making Mondragon. The group and dynamics of the worker cooperative complex* (2nd ed.). Ithaca, New York: ILR Press.
- Woodworth, W. P. (1986). Management from below. *Journal of Management*, 12(3), 391–402.

# ESTIMATING PRICING GAMES IN THE WHEAT-HANDLING MARKET IN SASKATCHEWAN: THE ROLE OF A MAJOR COOPERATIVE

Jing Zhang, Ellen Goddard and Mel Lerohl

## ABSTRACT

*In Canada, grain handling is an important agri-business that has traditionally been cooperative in nature (for example, Saskatchewan Wheat Pool). At the same time the industry is heavily regulated. There has been a dramatic change in the structure of the industry over the past 20 years and there are currently no major cooperatives present in the market. If the “yardstick effect” hypothesis of the role of cooperatives in an imperfectly competitive market is true, the disappearance of cooperatives could result in the ability of remaining firms to exercise market power over producers. To investigate the impact of changes in ownership structure in the market, we estimated two types of pricing games that might have been played between a cooperative, Saskatchewan Wheat Pool (SWP) and an investor-owned firm (IOF), Pioneer Grain (PG) in the Saskatchewan wheat-handling market over the period 1980–2004, with different assumptions about their pricing behavior imposed. We find that SWP and PG have likely been playing a Bertrand pricing game in the market over the period.*

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*We thus conclude that SWP, as the largest cooperative in the market, likely played a “yardstick effect” role in the market.*

## 1. INTRODUCTION

In Canada, grain handling is an important agri-business that has traditionally been cooperative in nature (for example, Saskatchewan Wheat Pool, Alberta Wheat Pool, Manitoba Pool Elevators, United Grain Growers Cooperative Limited). At the same time the industry is heavily regulated. For example, the Canadian Wheat Board owns and markets wheat, durum wheat, and barley on behalf of western Canadian grain growers through elevators managed by a number of cooperative and investor-owned firms (IOFs).<sup>1</sup> The Canadian Grain Commission (CGC), until August 1, 1995, was required to set maximum tariffs that elevator companies could charge for handling, cleaning, drying, and storage of grain at terminal, transfer, and primary elevators. Post August 1, 1995, the tariff system was deregulated with elevator companies still required to report tariffs to the CGC; however, they can charge farmers rates different from those they register and vary the rates charged.

There has been a dramatic change in the structure of the industry over the past 20 years. The market share of cooperatives in the sector was 70% in 1986, 74% in 1991, slightly down to 65% in 1996, dramatically down to 47% in 2000, and less than 20% in 2002 (Co-operatives Secretariat, Agriculture and Agri-food Canada, 2004). The changes in market shares in the industry reflect problems the traditional cooperatives may have had in raising capital for growth and renovation, necessitating changes in ownership. The 1990s has seen a wave of consolidation, acquisitions and mergers, in the grain-handling sector in Canada. Over this period, both United Grain Growers Co-operative Limited (UGG, July 27, 1993) and the Saskatchewan Wheat Pool (SWP, April 1, 1996) listed themselves on the Toronto Stock Exchange in an attempt to raise capital from private nonmember investors (Goddard, 2002). Subsequently, UGG entered into a strategic alliance with Archer Daniels Midland (an American based grain multinational) in the third quarter of 1997. In November 2001, Agricore (the former Alberta Wheat Pool and Manitoba Pool Elevators, merged in 1998) was merged with UGG, and this large company (Agricore United) is no longer a cooperative (Goddard, Boxall, & Lerohl, 2002). As of January 2005, the second-largest marketing cooperative in Canada (Co-operative Secretariat, 2004), Saskatchewan Wheat Pool, was the only cooperative remaining in the market. In March 2005, the Board of SWP announced that it had decided to

convert SWP into an investor-owned firm (IOF) largely as a result of debt problems (Appendix A) (Saskatchewan Wheat Pool, 2005).

“After several months of considering possible alternatives to strengthen the Pool’s balance sheet, the Board has determined that it is in the best interest of the Company to continue under the Canada Business Corporations Act with a more conventional share structure,” said Pool CEO Mayo Schmidt. “The plan approved to-day will position the Pool to raise equity in the public markets to further reduce debt and enhance liquidity.” (SWP, February 7, 2005)<sup>2</sup>

As a result, cooperatives have essentially disappeared from the grain-handling system in Canada. The Canadian grain-marketing system is currently concentrated, and there are no cooperatives present in that market. If the *yardstick effect* hypothesis of the role of cooperatives in an imperfect market is true, given concentration in the grain-handling market, the disappearance of cooperatives could result in increased opportunities for IOFs to exercise market power over producers, and result in a welfare loss for producers and a possible decrease in economic efficiency and total social welfare. If this is the case, policies to encourage competition in the market might be considered. Therefore, it is important to investigate the role cooperatives, specifically SWP, might have played in the grain-handling market. The grain-handling market in Saskatchewan where SWP is the dominant firm in the market is chosen as our study area. Due to data limitations, empirical analysis is conducted using wheat handling data of the market (since wheat is the dominant crop in the grain-handling agri-business in the region).

The paper is organized as follows. In the next section, the grain-handling market in Saskatchewan is briefly introduced. The literature on imperfect competition and game theory is reviewed in Section 3. Two types of non-cooperative pricing game models are introduced: a Bertrand–Nash game and a Stackelberg leader–follower game. In Section 4, estimation results are reported and discussed; the best-fitting game model is then selected. Based on the best-fitting model, the *yardstick effect* of a cooperative, in the case of wheat-handling in Saskatchewan is examined. Conclusions for the paper and areas for future research are presented in Section 5.

## 2. A REVIEW OF THE WHEAT-HANDLING MARKET

### 2.1. Wheat-Handling in Saskatchewan

In Saskatchewan, the wheat-handling market is characterized by a high level of concentration. Table 1 illustrates changes in concentration levels<sup>3</sup> in the

**Table 1.** Changes in Concentration Levels of Wheat-Handling Market in Saskatchewan (1980–2005 Fiscal Year).

	CR4 (%)	CR3 (%)	CR2 (%)	CR1 (SWP) (%)
1980–1985	94	88	75	59
1985–1990	94	87	74	59
1991–1995	90	83	71	56
1996–2000	85	79	67	51
2000–2005	67	60	47	33

*Note:* SWP is the largest company in the region over the period, so the market share for the top one company is actually SWPs market share. Pioneer Grain (PG) is the second-largest company in terms of market share for most years during the period 1980–2005 (22 out of 25 years). Other important players that once were one of the top four companies in the region are United Grain Growers (UGG/Agricore: Agricore was merged with UGG in 2001), Cargill Limited, and Louis Dreyfus Canada Limited (LDC).

wheat-handling market in the region over the period 1980–2005. The market share of the top four firms (CR4) in the region was stable at over 93% before 1990, after a quick dip below 90% during 1989–1992, back to over 90% until 1995. The market share has gradually decreased since then, stabilizing at over 60% approximately.

As Table 1 indicates, the decline in concentration in the market is largely due to the decline in market share of SWP in the region. Note that the significant decline in market share of SWP did not occur until 1995, after elevation tariffs had been deregulated, the company had begun to suffer financial problems, and many local elevators were closed (see Appendix A). Despite this, SWP, as a cooperative firm, is still the largest company in the region. In fact, the Saskatchewan grain-handling market had been dominated by cooperatives for decades. In addition to SWP, UGG, and AWP were two other important cooperatives in the region. The cooperatives had a stable market share of around 70% before Agricore became part of UGG and an IOF in 2001. In Saskatchewan, Pioneer Grain (PG) is the second-largest firm in wheat-handling for most of the years (22 out of 25 years). The market share of PG was about one fourth that of SWP in the early 1980s, increasing to about one third since early 2000, mainly due to SWPs decreasing market share (Fig. 1).

This study attempts to examine the potential *yardstick effect* of cooperatives using empirical data to test for various possible non-cooperative pricing games between a cooperative and an IOF. PG, as an IOF, is chosen as the rival of SWP for this analysis. As the top two firms in Saskatchewan, they account for about 50–75% of market share in the region (Table 1). It is

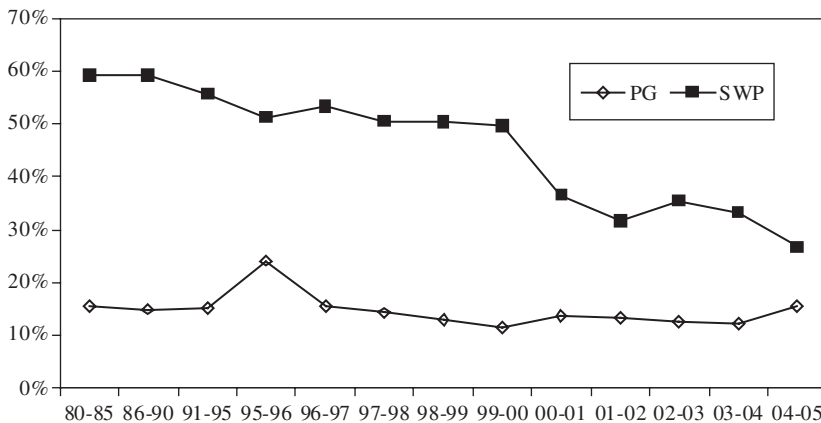


Fig. 1. Changes in Market Share of SWP and PG in Wheat-Handling Market in Saskatchewan (1980–2005).

expected that their pricing interactions would be a good approximation of decision dependence of the entire market. It would be ideal to incorporate other “significant” players into our empirical analysis, such as UGG and Cargill Limited as the third and fourth largest companies.<sup>4</sup> The former was a cooperative for most of the period (prior to November 2001), while the latter was an IOF. However, the complication in model estimation increases exponentially by including more than two firms, and the potential gain in insight is not obvious due to the added complexity involved. Since the underlying strategy played by each player is unknown to researchers, an exhaustive analysis of different combinations of strategies would be difficult when the number of players is large. For the purpose of this study, only strategies played by one cooperative and one IOF are conjectured and estimated.

### 2.2. A Game Theory Approach to Analyzing an Imperfect Competition Market

Rogers and Sexton (1994) point out that oligopsony market power is a significant issue in many first-handler markets, particularly in instances when one or more of the firms are cooperatives. Despite the significant policy implications of the issue, it has not gained sufficient empirical research attention across many commodity sectors or countries. Rogers and

Sexton (1994) develop a theoretical oligopsony model incorporating the spatial structure of producers, concentrated market structure, costly product transportation and noncompetitive conduct among processors to see how the farm-retail price spread is determined and to test for the “yardsticks of competition” hypothesis of the presence of cooperatives in the market. Their model suggests that where there is an open membership cooperative, the opportunities to exercise spatial market power are diminished and therefore, the existence of cooperatives in the market can have a pro-competitive effect. They call for future research to develop and implement empirical models to test for the existence of oligopsonistic power and the role of cooperatives in specific markets. Unfortunately, there has been little empirical work done since then. Earlier work by Fulton (1989) to examine the *yardstick effect* of a cooperative in an oligopolistic market suggested that the entrance of a cooperative into an oligopolistic industry can improve the efficiency of the industry.

We conduct an empirical study to estimate pricing games played by important players in the grain-handling market using market data, and to investigate the role cooperatives might have played in this market. We use non-cooperative game theoretical techniques to estimate pricing games played between a cooperative and an IOF in the context of grain handling in Saskatchewan. Specifically we examine interactions between elevation charges for wheat set by the two companies in Saskatchewan. The approach of estimating empirical pricing games to examine market structure has been used extensively in marketing pricing models, see for example, Kadiyali, Vilcassim, and Chintagunta (1996), Rao et al. (1994), Vickner and Davis (2004), and Shank (2004). In this paper, we specify models with different hypothesized conjectural pricing decisions of each player (one of which is a cooperative firm) with different pricing games: Bertrand–Nash games and/or Stackelberg leader–follower games. We choose to fit our data using these two types of models as a starting point since they are the two classical models in non-cooperative game theory. It is likely that firms in the region compete by setting capacities first and then setting price or quantity (Kreps & Scheinkman, 1983; Scheinkman & Schechtman, 1983). Indeed, there has been a structural change in the number of elevators owned by each firm since the introduction of high-throughput elevators, affecting both the spatial distribution of elevators and elevator capacity in the region (Appendix A). This implies a two-stage strategic interaction, a more complicated firm behavior than we assume. Other complex games, such as a Krishna–Benoit model that hypothesizes firms compete in the short term in price and longer term in quantities must await future research (Benoit &

Krishna, 1987). As a first empirical attempt, it is logical to start from a basic model and then move to more complicated ones.

Despite the fact that Sexton (1990) suggests that buyer market power issues could be significantly different from seller market power issues due to spatial structure and the possible involvement of at least one cooperative as player, the literature on oligopsony has been largely limited to the theoretical level (Rhodes, 1983; Cotterill, 1986; Sexton, 1986; Fulton & Giannakas, 2001). Empirical research on market power in which cooperatives are one of the players has mainly focused on oligopolistic market structures. For example, Fulton (1989) conducted empirical research to examine the impact of the entry of cooperatives on oligopolistic industries through pricing strategies. However, he did not deal with pricing-strategy interactions between important players in an imperfect market. Understanding these interactions could be very important for forecasting and predicting movements in market price and demand levels (Kadiyali et al., 1996). In the Saskatchewan wheat market a grain-handling cooperative cannot make profits from buying and selling wheat (since wheat is 'owned' by the Canadian Wheat Board), the variable which cooperatives could use to play games is the charge to farmers for services, elevation charges. Cooperatives or other grain-handling companies could play different games on farm and wholesale level pricing for off-board grains and other products. They may also have ancillary services, such as farm supplies, which could affect their overall pricing strategies.

Most non-cooperative pricing game studies in the industrial organization literature typically assume that the participatory firms are IOFs, see for example, Kadiyali et al. (1996), Roy et al. (1994) and Vickner and Davies (2000). To our knowledge, there have been almost no published empirical studies analyzing pricing competition between cooperatives and IOFs using the pricing game technique. Shank (2004) studied the non-cooperative game between cooperatives and IOFs in the poultry sector in Canada. He found that while Lilydale acts as a producer cooperative, other participants treat Lilydale as an IOF. In his analysis of pricing games for fluid milk pre and post the sale of the major cooperative in western Canada to an IOF, Huang (2004) found that the presence of a cooperative in an oligopolistic market increases market competition.

According to game theory and cooperative theory, in a non-cooperative game, if one player is a cooperative, and as long as it acts as a cooperative (following a strategy of maximizing member welfare, the sum of firm profits and member producer welfare, Taylor, 1971; Enke, 1945; Bateman, Edwards, & LeVay, 1979) so that it always sets price at marginal cost, the game

outcome would be socially optimal. That is, the equilibrium level of quantity would be the same as that under a perfectly competitive market structure. Therefore, theoretically, the presence of a cooperative in an imperfect market could increase efficiency and social welfare. However, if a cooperative does not act as a cooperative, that is, it acts as an IOF (essentially maximizing profit rather than maximizing member welfare), different types of pricing games would result in different market levels of quantity/price which might diverge from the social optimum. In general, if firms are following Bertrand–Nash pricing games, this represents a more competitive game than a Stackelberg leader–follower game (Carlton & Perloff, 2000; Singh & Vives, 1984).

After estimating models with conjectural pricing games, a criterion needs to be used to determine the best-fitting model. Since the estimated models are non-nested models, it would be preferable to use a likelihood dominance criterion (Pollak & Wales, 1991) or likelihood ratio tests (Vuong, 1989) for non-nested hypothesis testing. Therefore, a full information maximum likelihood (FIML) method would be appropriate. In a similar study, Kadiyali et al. (1996) reported that due to the high degree of collinearity in the price and quantity data and complexity involved in estimating a variance–covariance matrix of a system of equations, they could not obtain a FIML model. In fact, a seemingly unrelated regression (SUR) method is widely used in such analysis. As a result, we choose the best-fitting model based on the minimized total sum of squared errors (TSSE) reported by the estimated SUR models. The best-fitting model can be used to identify whether the *yardstick effect* of a cooperative in the market appeared to be present or not in the historical sample period. One advantage of this research routine is that it can “let the data speak” by estimating various possibilities and picking the “best” model. However, an obvious downside is that if there were measurement errors in the dataset, the best-fitting model might not be the true model.

### 3. MODELS

As mentioned earlier, two types of pricing game models are estimated in this paper: Bertrand–Nash models and Stackelberg leader–follower models. Saskatchewan Wheat Pool, as a cooperative, is assumed to maximize the sum of its profits and member welfare. Therefore, SWP would set its price (in this case wheat elevation charges) equal to its marginal cost if it acts as a cooperative. However, it is possible that managers of SWP aim to maximize profits of the firm, so that they set their price in response to their rival’s price. In 1996, SWP became a partially publicly traded company. It is likely

that nonmember shareholders could have pressured the company to behave more like an IOF. PG, as an IOF, is assumed to maximize its profit.

Let the demand for elevation services facing each firm be linear in prices and other exogenous variables (Gasmi & Vuong, 1991), represented as follows (for details, see Appendix B):

$$q_{it} = \alpha_i + \gamma_{i1}p_{it} + \gamma_{i2}p_{2t} + X_{it}, \quad i = 1,2 \tag{1}$$

where  $i$  represents firms: 1 represents SWP and 2 represents PG,  $q$  represents the amount of wheat handled by a firm at its primary elevators in Saskatchewan,  $p$  represents elevation charges<sup>5</sup> set by the firm,  $X$  represents other exogenous variables and parameters. For simplicity, we omit the time subscript, for a given year  $t$ ,

$$X_i = e_i p_i(-1) + k_i \text{time} + l_i \text{policy} + i_i \text{cap}_i + j_i \text{exptp} \tag{2}$$

where  $p(-1)$  is lagged prices,  $\text{cap}$  is total capacity of primary elevators owned by a firm within a region,  $\text{exptp}$  is the Canadian wheat export price index in a given year,  $\text{time}$  is a time trend to account for technology changes,  $\text{policy}$  is a dummy variable that indicates 1 if elevation tariffs are deregulated (no longer having maxima set by the CGC), i.e. it takes a value of 1 during the period from 1995 to 2004. Note that Eq. (1) implies that elevator handling services provided by SWP and PG are quality-differentiated products. This is an important assumption because otherwise, with homogeneous goods, Bertrand competition would have both firms pricing at marginal cost regardless of whether they are cooperatives or IOFs. This assumption is likely to be appropriate for this study. Farmers are likely to perceive handling services provided by one firm as different from another because these services are typically characterized by multiple attributes, of which some are quantitative and some are qualitative. For example, the services provided by SWP might be considered more reliable by farmers, especially for those who are members of SWP. For another example, differences in spatial structure of elevators between the two firms might cause transportation costs borne by farmers from fields to elevators to differ. Up to the year 2000, the number of elevators owned by SWP was about three times the number owned by PG (Appendix C).

One of the key variables in this study is marginal cost. Unfortunately, there are no existing data on marginal cost (related to the provision of elevation services) of the two firms due to the confidential nature of the data. To facilitate model estimation, we assume constant marginal cost following Kadiyali et al. (1996). This assumption, though it seems at first glance to be restrictive, may be realistic in this study. Early findings from cost studies of



the country elevator system have shown that there has been a mixed effect on the marginal cost of grain handling as the capacity of an elevator increases (e.g. Askin, 1988). On the one hand, the turnover<sup>6</sup> of grain handling decreases, leading to an increase in marginal cost; and on the other hand, the scale increases (such as fewer staff are needed), leading to a reduction in marginal cost. The two effects may offset each other, resulting in a relatively stable marginal cost of grain handling over the years.<sup>7</sup>

For firm  $i$  in the year  $t$ , the total costs of firm  $i$  are,

$$TC_{it} = MC_i \times q_{it} \quad (3)$$

So, the profit function for an IOF firm  $i$  is

$$\pi_i = (p_i - MC_i)q_i \quad (4.1)$$

and the objective function for a cooperative firm  $i$  is (Fulton, 2001),

$$\pi_i = (p_i - MC_i)q_i + \text{member welfare} \quad (4.2)$$

where  $\pi_i$  and  $MC_i$  represent profit and marginal cost for wheat handling by firm  $i$ . Since  $MC_i$  is unknown, it will be estimated as a parameter.

In a Bertrand–Nash game, a typical firm (i.e. IOF) develops a marketing strategy by optimizing its own prices with respect to its own profit function. The following first-order condition (FOC) can be derived:

$$\frac{\partial \pi_i}{\partial p_i} = d_i + a_i p_i + b_i p_j + X_i + \gamma_{ii}(p_i - MC_i) = 0 \quad (5)$$

In our case,  $\gamma_{ii} = a_1$  for SWP,  $\gamma_{ii} = b_2$  for PG.

Solving the FOC for  $p_i$  we derive a price reaction function for firm  $i$  if it is to maximize its profit,

$$p_i = -\frac{1}{2\gamma_{ii}}(d_i + b_i p_j + X_i) + \frac{MC_i}{2} \quad (6)$$

However, as a cooperative, if the managers of SWP aimed to run the company as a cooperative, they would have set their tariffs/price to their marginal costs regardless of what tariffs/prices had been set by their rival (Fulton, 2001). So,

$$p_i = MC_i, \quad i = 1 \quad (7)$$

Since the underlying game played by the two companies is unknown from the outside, we specify two possible scenarios about the price strategies played at equilibrium: (1) SWP set its price at its marginal cost, and is treated as a cooperative by PG; (2) SWP set its price to maximize its profit like an IOF, and is treated as an IOF by PG. If SWP behaves like an IOF, its

price should be set as Eq. (6) indicates, but if SWP behaves as a cooperative, it would set price according to Eq. (7). The rival of SWP, PG would react to the price set by SWP according to Eq. (6) if it treats SWP as an IOF. If PG treats SWP as a cooperative, and knows SWP would price at its marginal cost, its “price reaction function” becomes,

$$p_i = -\frac{1}{2\gamma_{ii}}(d_i + X_i) + 0.5MC_i - \frac{b_i}{2\gamma_{ii}} \times MC_j, \quad i = 2, j = 1 \quad (8)$$

which is essentially not a function of SWP’s price.

Depending on specific behavioral assumptions, combining demand Eq. (1) and price reaction functions (6), (7) or (8), a system of input demand equations and price reaction equations that incorporate the non-cooperative pricing strategies by the two firms can be developed.

In a typical Stackelberg leader–follower game with two players, one firm behaves as a leader and the other firm follows. The leader develops a marketing strategy taking into account the optimal marketing decision of the follower. The choice of an initial leader is not important as long as each firm is given the same opportunity to lead (Carlton & Perloff 2000; Huang, 2004). First, derive the price reaction function of the follower by solving the follower’s profit-maximization problem, which is Eq. (6). Next, substitute the followers’ price reaction functions into the leader’s profit-maximizing function and solve for the price of the leader when the FOC is satisfied.

For a two-firm Stackelberg game, let the follower be firm 1 and the leader be firm 2, the leader’s profit function is:

$$\pi_2 = (p_2 - MC_2)q_2 \quad (9)$$

The demand equation for the leader’s product is substituted into the profit function:

$$\pi_2 = (p_2 - MC_2)(\alpha_2 + \gamma_{21}p_1 + \gamma_{22}p_1 + X_2) \quad (10)$$

Then, the leader makes a conjecture about the follower’s best responses, substituting the follower’s price reaction function (i.e. Eq. (6)) into its own profit function to replace  $p_i$ .

Deriving the leader’s FOC and solving with respect to  $p_2$ , the leader’s price reaction function is defined as follows:

$$p_2 = -\frac{1}{(2\gamma_{22} - (\gamma_{21}\gamma_{12})/(\gamma_{11}))} \left( \alpha_2 - \frac{\gamma_{21}\alpha_1}{2\gamma_{11}} - \frac{\gamma_{21}X_1}{2\gamma_{11}} + X_2 - MC_2 \left( \gamma_{22} - \frac{\gamma_{21}\gamma_{12}}{2\gamma_{11}} \right) + \frac{MC_1}{2}\gamma_{21} \right) \quad (11)$$

So, the optimal price of the leader is a function of parameters and variables affecting the demand for both the leader and the follower. Notice that the follower's price  $p_i$  is not included in the leader's price reaction function directly because it is substituted out when it is incorporated into the leader's profit-maximization function. Implicitly, factors affecting the price of the follower are incorporated into the optimal pricing strategy by the leader.

Similar to the Bertrand pricing game, we specify different scenarios about the price strategies used by SWP and PG. If SWP indeed behaves as a cooperative, it cannot be a price leader because it would always set its price at its marginal cost. If SWP, however, behaves as an IOF, it could be a price leader. Therefore, three scenarios are considered: (1) SWP sets its price at its marginal cost, and is treated as a cooperative by PG; (2) SWP sets its price to maximize its profit like an IOF, and is treated as an IOF by PG, but PG leads; (3) SWP sets its price to maximize its profit like an IOF, and is treated as an IOF by PG, but SWP leads. In the first scenario, PG treats SWP as a cooperative, i.e. PG knows SWP would set its price at its marginal cost, so  $p_i$  in the Eq. (10) is replaced with the marginal cost in PG's profit-maximization problem. It turns out that when SWP sets its price as a cooperative and is treated as a cooperative by PG, the Stackelberg leader–follower game model degenerates into a Bertrand game, since the follower's pricing strategy does not depend on the leader's pricing strategy. Therefore, only scenarios 2 and 3 of a Stackelberg game are estimated. Scenario 2 assumes PG is the price leader while Scenario 3 assumes SWP is the price leader. If SWP leads, the price reaction function of  $p_1$  is symmetric to Eq. (11),

$$p_1 = -\frac{1}{(2\gamma_{11} - (\gamma_{12}\gamma_{21})/(\gamma_{22}))} \left( \alpha_1 - \frac{\gamma_{12}\alpha_2}{2\gamma_{22}} - \frac{\gamma_{12}X_2}{2\gamma_{22}} + X_1 - MC_1 \left( \gamma_{11} - \frac{\gamma_{12}\gamma_{21}}{2\gamma_{22}} \right) + \frac{MC_2}{2} \gamma_{12} \right) \quad (12)$$

Therefore, there are a total of four models to be estimated, two Bertrand models, named as Bertrand 1, and Bertrand 2 respectively and two Stackelberg models, named as Stackelberg 1 and Stackelberg 2 corresponding to the above scenario 2 and scenario 3 separately (see Appendix B for a list of the systems of equations estimated for each model).

Annual data on quantity, elevation charges of wheat handling and total elevator capacity of primary elevators for SWP and PG in Saskatchewan over the period 1980–2004 fiscal years are collected by the CGC (Canadian Grain Commission, 1980–2005a, b, c). Export prices of wheat and the consumer price index that are used to deflate the nominal prices are from the

**Table 2.** Definitions of Variables.

Variables	Definition	Mean	Standard Deviation
qswp <sub><i>t</i></sub>	Amount of wheat handled by Saskatchewan Wheat Pool for a given year, in tons	4,808.47	364.14
pswp <sub><i>t</i></sub>	Elevation charges at primary elevators owned by Saskatchewan Wheat Pool, in real terms (deflated by CPI)	8.37	0.14
pswp <sub><i>t-1</i></sub>	Lagged elevation charges by Saskatchewan Wheat Pool, in real terms	–	–
qpg <sub><i>t</i></sub>	Amount of wheat handled by Pioneer Grain for a given year, in tons	1,593.49	144.69
ppg <sub><i>t</i></sub>	Elevation charges at primary elevators owned by Pioneer Grain, in real terms (deflated by CPI)	8.24	0.13
ppg <sub><i>t-1</i></sub>	Lagged elevation charges by Pioneer Grain, in real terms	–	–
capswp <sub><i>t</i></sub>	Total capacity of primary elevators owned by Saskatchewan Wheat Pool, in tons	1,815.09	86.26
cappg <sub><i>t</i></sub>	Total capacity of primary elevators owned by Pioneer Grain, in tons	610.51	29.52
exptp <sub><i>t</i></sub>	Price index of Canadian exported wheat	99.00	23.03
time <sub><i>t</i></sub>	Time trend	–	–
policy <sub><i>t</i></sub>	Dummy variable that takes value of 1 if the year is after 1995, 0 otherwise	0.38	–

*Notes:* Elevation charge includes elevation service only, i.e., receiving, elevating, and loading out.

Statistics Canada Database CANSIM II (Statistics Canada). This is a relatively small sample size given a total of 18 parameters needing to be estimated. The definition of variables is shown in Table 2.

#### 4. RESULTS

A preliminary estimation of the specified models without the imposition of any theoretical restrictions found that the estimated own-price elasticities for PG in all models were positive and most of them were significant. In addition, the estimated cross-price elasticities between the two firms had opposite signs and they were significant, which suggested that the wheat-handling service provided by PG was a substitute for SWP and, at the same time, the wheat-handling service provided by SWP was a complement for PG. This is rather counter-intuitive. Therefore, symmetric cross-price

elasticity restriction imposed models were estimated assuming that Hicksian elasticities can be approximated by Marshallian elasticities (Wohlgemant, 1993). Let  $\varepsilon_{12}$  represent percentage of quantity changes in wheat handled by SWP in response to a price change by PG, and  $\varepsilon_{21}$  represent percentage of quantity changes in wheat handled by PG in response to a percentage change in the price of SWP,

$$\varepsilon_{12} = \frac{\partial q_{swp}}{\partial p_{pg}} \times \frac{p_{pg}}{q_{swp}} = \gamma_{12} \frac{p_{pg}}{q_{swp}};$$

$$\varepsilon_{21} = \frac{\partial q_{pg}}{\partial p_{swp}} \times \frac{p_{swp}}{q_{pg}} = \gamma_{21} \frac{p_{swp}}{q_{pg}}$$

$\varepsilon_{12} = \varepsilon_{21}$ , so that,

$$\gamma_{21} = \gamma_{12} \frac{p_{pg}}{q_{swp}} \times \frac{q_{pg}}{p_{swp}}$$

Since elasticities are typically estimated at the mean,

$$\gamma_{21} = \gamma_{12} \frac{\overline{p_{pg}}}{\overline{q_{swp}}} \times \frac{\overline{q_{pg}}}{\overline{p_{swp}}} = 0.326\gamma_{12}$$

Replacing  $\gamma_{21}$  with  $0.326\gamma_{12}$  in Eqs. (B.1)–(B.4) in Appendix B, we can obtain restricted versions of Bertrand and Stackelberg models.

A total of four models, two Bertrand models and two Stackelberg models are estimated with symmetric cross-price elasticity restrictions imposed on the systems of equations using TSP<sup>®</sup> SUR estimator.<sup>8</sup> We attempted to estimate the model using a FIML method, which would allow us to perform rigorous statistical hypothesis testing (such as chi-square statistics) based on log-likelihood values, but we failed to obtain converged FIML estimates. The reasons are probably the same as the ones outlined by Kadiyali et al. (1996). Following Kadiyali et al. (1996), Shank (2004), and Huang (2004), the best-fitting model is chosen based on the minimized TSSE. In fact, due to the high collinearity of price and quantity data between the firms, first-order differences in prices are used in the estimation. However, the power of the TSSE based criterion is unknown. Therefore, the out-of-sample prediction power of each model is also examined. We use the estimated models with updated exogenous variables to predict quantities and prices for each firm for the calendar year 2004–2005. However, accurate out-of-sample prediction for one year may not be sufficient for determining the best-fitting model either. The data for 2004–2005 could be an outlier or have some measurement error. If the two criteria are consistent with each other, i.e. the best-fitting model chosen according to the TSSE criterion also give the

closest prediction of the actual data, we have more confidence in the model chosen in terms its reliability in describing actual market behavior.

Table 3 indicates the overall fit of games in terms of the minimized TSSE criteria. We find out that the best-fitting game is Bertrand model 1, in which SWP is assumed to act as a cooperative and is treated as a cooperative by PG. Since a Bertrand game indicates a more competitive market than a Stackelberg game, this result implies that the existence of the cooperative, that is, SWP, might have played a procompetition role in the grain-handling market in the region.

In Table 4, the predicted quantities and prices for SWP and PG for 2004–2005 are compared. Remember that the models are estimated using data from 1980 to 2004, so the predictions are out-of-sample predictions. Overall, the four models do not have strong predictive power, probably because the market has undergone rapid structural change over the period. Relatively speaking, Bertrand models have better predictive power than

**Table 3.** Overall Fit of Games in Terms of TSSE.

Models	Behavior Assumptions	Minimized Total Sum of Square Errors
Bertrand model 1	SWP behaves as a cooperatives treated as a cooperative	2.626E + 07
Bertrand model 2	SWP behaves as an IOF, treated as an IOF	2.632E + 07
Stackelberg model 1	SWP behaves as an IOF, treated as an IOF, PG leads	2.736E + 07
Stackelberg model 2	SWP behaves as an IOF, treated as an IOF, SWP leads	2.649E + 07

**Table 4.** Comparison of Out-of-Sample Prediction of Quantities and Prices Across Estimated Models.

	Quantity Handled by SWP (QSWP)	Quantity Handled by QPG (QPG)	Price Charged by SWP (PSWP)	Price Charged by PG (PPG)
Actual data for 2004–2005	1,791.14	833.09	9.45	9.53
Prediction for 2004–2005				
Bertrand model 1	1,233.30	559.73	9.18	9.13
Bertrand model 2	953.38	955.23	7.61	7.53
Stackelberg model 1	4,626.81	–2,751.98	5.14	8.92
Stackelberg model 2	–827.73	877.83	8.39	8.45

Stackelberg models. The latter predicts negative demand for wheat for a firm acts as a leader, which does not make sense. For both Bertrand models, prices for SWP and PG for 2004–2005 are under-predicted, especially for Bertrand model 2. Bertrand model 2 also erroneously predicts the quantity handled by PG ( $q_{pg}$ ) is larger than that by SWP ( $q_{swp}$ ). In contrast, Bertrand model 1 predicts the quantity handled by SWP is more than twice as that by PG, which is more consistent with actual data. Although Bertrand model 1 under-predicts quantity data by almost a third, the predicted prices are the closest to the actual data comparing to other models. Therefore, we conclude that Bertrand model 1 has the highest prediction power. Therefore, Bertrand model 1 is considered to be the best-fitting model in this study because it has the lowest TSSE but highest out-of-sample prediction power.

Another way to justify the appropriateness of a model is to see whether the model makes economic sense. So it would be meaningful to compare the estimation results for the different games and see whether Bertrand model 1 makes more sense economically. Estimation results of Bertrand models 1 and 2 and Stackelberg models 1 and 2 are reported in Tables 5 and 6 respectively. Exploratory modeling exercises indicate that models estimated with equal marginal cost restriction imposed have generally lower TSSE overall, models reported in Tables 5 and 6 are thus specified with one marginal cost parameter.

Tables 5 and 6 show that the marginal cost parameter estimated by Stackelberg model 1 is negative. Not coincidentally, this model has much higher minimized TSSE as compared to other models. Therefore, comparison analysis will be mainly focused on the other three estimated models: Bertrand models 1 and 2 and Stackelberg model 2.

Overall, the three models have more significant estimates for SWP than for PG. This implies that the specification of the models does a better job in describing SWP's behavior. This probably reflects the fact that SWP, as the largest firm in the region, dominates the market behavior. The estimated coefficients in these three models are generally consistent, though not completely. Stackelberg model 2 wrongly predicts the own-price effect for SWP is positive, although insignificant. Our best-fitting model, Bertrand model 1, estimates a negative but insignificant own-price effect for SWP, a somewhat disappointing finding. If this result is valid, it might indicate SWP reacts more to its rival than market demand, a fact might be true given its dominance over the market in the region.

Estimates for other variables are more consistent across models in terms of signs and significance levels. For example, the dummy variable representing deregulation of elevation tariff policy (*policy*) is found to have a

**Table 5.** Estimation of Bertrand Models with Symmetric Elasticity Restriction Imposed.

Variable/Coeff. Name	Bertrand Model 1 SWP Behaves as a Coop, Treated as a Coop		Bertrand Model 2 SWP Behaves as an IOF, Treated as an IOF	
	Estimate	t-ratio	Estimate	t-ratio
Demand equation for SWP				
Constant (D1)	-14,807.90**	-3.00	-13,035.30**	-2.64
PSWP (A1)	-1,057.76	-1.17	-1,429.63**	-2.09
PPG (B1)	1,978.42**	2.66	1,891.00**	2.70
PSWP(-1) (E1)	667.17	0.96	517.88	0.74
TIME (K1)	403.71**	3.15	367.08**	2.87
POLICY (L1)	-3,912.04**	-3.40	-3,640.27**	-3.18
CAP (I1)	7.49**	4.24	6.74**	3.84
EXPTP (J1)	25.60*	1.66	24.80	1.62
Demand equation for PG				
Constant (D2)	3,664.39*	1.74	3,814.79*	1.79
PSWP (A2)	645.46	-	616.94	-
PPG (B2)	-1,240.87**	-4.70	-868.59**	-2.96
PPG(-1)(E2)	-754.22**	-2.87	-646.61**	-2.42
TIME (K2)	-73.02	-1.51	-79.41	-1.62
POLICY (L2)	201.87	0.36	40.38	0.07
CAP(I2)	-1.30	-0.46	-1.37	-0.47
EXPTP(J2)	-4.81	-0.65	-3.98	-0.53
MC	8.08**	1.96	5.84**	2.34
TSSE	2.626E+07		2.632E+07	

Note: Due to the high collinearity of the price and quantity data, first-order price differences are actually used in estimation. The coefficient of PSWP in the demand equation for PG is calculated by multiplying the coefficient of PPG in the demand equation for SWP with 0.326, the ratio of average revenue of PG with respect to SWP. TSSE is total sum of square residues.

\*Denotes the 10% significance level.

\*\*Denotes the 5% significance level.

significant negative effect on the amount of wheat handled by SWP but insignificant effect on the amount of wheat handled by PG. This is what is expected: the regulation of elevation tariffs may have created an entry barrier for other firms. The deregulation of elevation tariffs therefore could have adversely impacted on the cooperatives by encouraging the entry of other firms looking for higher profit potential. The impact was not as likely to be felt by IOFs such as PG operating in the market.

Elevator handling capacity is found to have statistically significant and positive effects on the amount of wheat handled for SWP but not for PG.



**Table 6.** Estimation of Stackelberg Models with Symmetric Elasticity Restriction Imposed.

Variable Name	Stackelberg Model 1 SWP Behaves as an IOF, Treated as an IOF, PG Leads		Stackelberg Model 2 SWP Behaves as an IOF, Treated as an IOF, SWP Leads	
	Estimate	<i>t</i> -ratio	Estimate	<i>t</i> -ratio
Demand equation for SWP (QSWP)				
Constant (D1)	-15,520.40**	-3.20	-13,833.10*	-2.80
PSWP (A1)	-1,003.50**	-2.13	810.27	1.08
PPG (B1)	2,499.76**	4.19	761.67	1.01
PSWP(-1) (E1)	843.75	1.24	694.93	1.00
TIME (K1)	416.82**	3.30	376.17**	2.93
POLICY (L1)	-4,151.23**	-3.67	-3,684.92**	-3.20
CAPSWP (I1)	7.76**	4.50	7.40**	4.21
EXPTP (J1)	27.16	1.79	19.65	1.27
Demand equation for PG (QPG)				
Constant (D2)	3,795.68*	1.77	3,634.75*	1.69
PSWP (A2)	815.55	-	248.49	-
PPG (B2)	-706.68**	-2.62	-612.49**	-2.03
PPG(-1)(E2)	-595.97**	-2.26	-545.16**	-2.02
TIME (K2)	-82.69	-1.68	-76.60	-1.55
POLICY (L2)	-40.22	-0.07	-37.57	-0.07
CAPPG(I2)	-1.22	-0.42	-1.27	-0.44
EXPTP(J2)	-4.07	-0.54	-2.85	-0.38
MC	-0.57	-2.03	6.43	0.83
TSSE	2.736E+07		2.649E+07	

*Note:* The coefficient of PSWP in the demand equation for PG is calculated by multiplying the coefficient of PPG in the demand equation for SWP by 0.326, the ratio between average revenue of PG and SWP.

\*Denotes the 10% significance level.

\*\*Denotes the 5% significance level.

Inclusion of this variable not only captures the size effect of each firm on wheat handling (the mean of total capacity of SWP is more than three times greater than that of PG, Table 2), but also the spatial distribution of elevators across the Saskatchewan region owned by each company in general, given that the total capacity of elevators is closely correlated with the number of elevators (Appendix B). Farmers across the region might have easier access to the handling services offered by SWP than PG, a factor that probably affects the quantity of wheat handled independent of a price effect. The export price of wheat (*exptp*) is expected to have a positive effect on the

amount of wheat handled, but it is found to be not significant in any of the models and some models result in wrong signs.

The estimated marginal cost differs significantly across the three models. According to Bertrand model 1, the chosen best-fitting model, the marginal cost is \$8.08/ton, very similar to the average prices of the two firms over the period 1980–2003. The other two models predict much lower marginal cost. As mentioned earlier, we have some concern about the constant marginal cost assumption. In fact, when we re-estimate the models using the annual deflated minimum elevation charges as a proxy for marginal cost data in the region, the ranking of the goodness of fit of the four models based on the TSSE criterion does not change. This indicates that the chosen best-fitting model is robust in this study.

In *Table 7* a report of  $R^2$  values for the demand and price reaction equations of each model is presented. On the  $R^2$  criterion, Bertrand model 1 and Stackelberg model 2 have much higher explanatory power than the other two models. The  $R^2$  values of price reaction equations are generally lower than demand equations. In fact, the fit indicated by  $R^2$  values seems to be consistent with the minimized TSSE criterion. Bertrand model 1 is the best-fitting model according to the TSSE criterion, the  $R^2$  values also suggest that the Bertrand model 1 has reasonable high explanatory power.

In *Table 8* the price elasticity estimates derived from the demand equations are summarized. Note that we estimate the models with symmetric cross-price elasticity restrictions imposed. The own-price elasticity estimates are found to be negative and are statistically significant for PG across all models, but not for SWP. For most models the estimated cross-price elasticities are found to be statistically significant with the exception of the

**Table 7.** *R*-squared Values of Equations in Bertrand and Stackelberg Models.

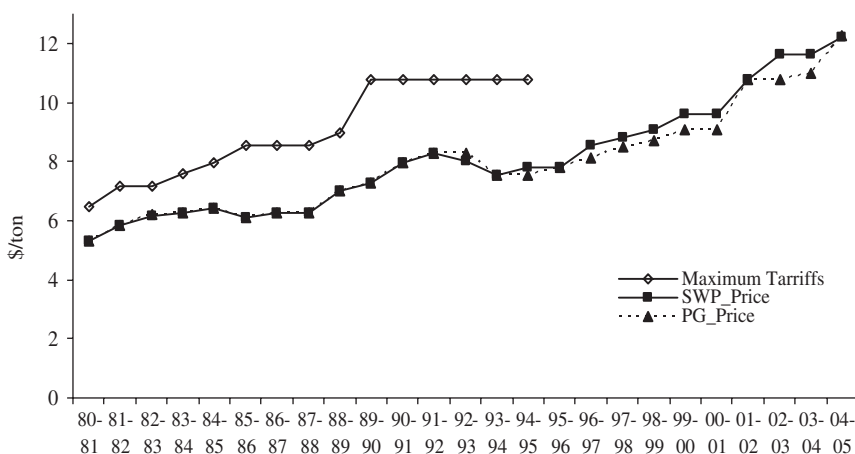
	Bertrand Models		Stackelberg Models	
	Demand Equations	Price Reaction Equation	Demand Equations	Price Reaction Equation
Model 1				
SWP	0.70	0.66	0.69	0.01
PG	0.57	0.45	0.58	0.24
Model 2				
SWP	0.69	0.17	0.69	0.70
PG	0.61	0.49	0.63	0.35

**Table 8.** Estimated Own-Price and Cross-Price Elasticities.

	Bertrand Model 1	Bertrand Model 2	Stackelberg Model 1	Stackelberg Model 2
Own-price elasticity				
$\epsilon_{11}$	-1.84	-2.49*	-1.74*	1.41
$\epsilon_{22}$	-6.41**	-4.49**	-3.65**	-3.17**
Cross-price elasticity				
$\epsilon_{12}(\epsilon_{21})$	3.38**	3.23**	4.28**	1.30

\*Denotes the 10% significance level.

\*\*Denotes the 5% significance level.



*Fig. 2.* Maximum Tariffs and Elevation Tariffs Charged by SWP and PG in the Saskatchewan Region (in Nominal Terms 1980–2004) *Source:* Canadian Grain Commission (1980–2005d). Annual Report.

Stackelberg model 2. Our best-fitting model, Bertrand model 1 estimates that the cross-price elasticity between the two firms is 3.38, which indicates the market is highly competitive.

So, how likely is it that the Bertrand model 1 is the true model, in which SWP acts as a cooperative and is treated as a cooperative by PG? The grain market has long been heavily regulated prior to 1995, and SWP became a TSE listed company in 1996. Prior to 1995, the prices charged by SWP and PG are heavily mingled with each other (Fig. 2) and it is only since 1995, that we start to see some dispersion of prices between the two firms, a period in which SWP is mostly a partially publicly traded company. Based on the

estimated Bertrand model 1, the price reaction elasticity of SWP with respect to PG's price is estimated to be 0.26 at the 1% significance level. Based on this model, the existence of SWP does appear to create a more competitive market and the *yardstick effect* of a cooperative is found in this study.

Given SWP's dominant market share in Saskatchewan, it is not surprising we find that SWP and PG might have been playing a Bertrand game. However, our finding is subject to many behavioral assumptions and possible data flaws. It might still be early to conclude that the Bertrand game is the game truly played by the two firms. Despite being the best-fitting model, Bertrand model 1 under-predicts quantities by about one third and generates a statistically insignificant own-price elasticity for SWP. We also find the estimation of the system of equations is very sensitive to small changes in prices, due to the high collinearity of data or simply because of large measurement errors associated with price data. On one hand, the grain-handling market was heavily regulated prior to 1995 by maximum tariffs set by the CGC; and on the other hand, reported elevation tariffs might not reflect the true prices charged by the companies. According to [Agriculture and Agri-food Canada \(2004\)](#), grain companies attract grain through favorable blending practices, trucking premiums, and service packages tied to delivery from farm to primary elevators. Without that information, it is difficult to incorporate the true price charged by each firm into a model. Also, we assume a one-shot static game, which does not take into account the possibility of optimizing pricing strategies across years. As mentioned earlier, since there has likely been a change in firm behavior after 1995, the assumption of only one type of game played over the whole period might be inappropriate. Despite the fact that we include a variable indicating the firm capacity that might be able to capture some information related to spatial distribution, the spatial structure of the grain market is not directly accounted for in this study. Therefore, there is a need for further research on models that explicitly deal with oligopsony market power. Since this study is the first step toward empirical analysis of pricing interaction between a cooperative and an IOF, future research would be to explore model fitness with more complex multi-stage mixed strategies are assumed.

## 5. CONCLUSION

This paper is an empirical study using a game theory approach to analyzing price behavior between a cooperative and an IOF in a regulated market, an area that has not been seriously explored empirically. We estimated pricing

game models with different behavioral assumptions about a cooperative and an IOF, and select a best-fitting model based on a minimized TSSE criterion and out-of-sample prediction power. We find that SWP and PG have likely been playing a Bertrand pricing game. SWP did appear to behave as a cooperative in the market over the period in general. As a result, we conclude there is a *yardstick effect* of the cooperative in the grain-handling market in the region. The average price charged by SWP is \$8.37 per ton over the period, which is higher than \$8.24 charged by PG. However, this difference in average price is largely explained by the higher prices charged by SWP in the post 1995 era (see Fig. 2). Prior to 1995, PG's charges were often higher than SWPs. Possible inferences are that post 1995, non-member shareholders forced the Board to pursue profit maximization only, or that SWP's marginal cost were indeed higher than those of other firms. From looking at the data and at our model, the *yardstick effect* of SWP was likely more pronounced in the period prior to 1995 than after. As the market share of SWP in the grain-handling sector in the region has declined substantially, market concentration is decreasing. It may also be true that there will be efficiency gains associated with these changes as the market becomes more competitive. This anomaly, increasing competitiveness with declining market share of SWP, probably arises both from the combination of SWPs prior dominant position in the Saskatchewan grain-handling market, from the growth of other competitors in the marketplace, and from consequent pressures to continue marginal cost pricing despite SWPs conversion to an IOF. On the policy front, a variety of hypotheses are also suggested by this result: Were the financial problems that led SWP to become an IOF associated with its pricing strategy, in particular its possible unwillingness to act as an imperfect competitor in the market for elevator services? Or did those changes arise from totally unrelated concerns such as cost control or investment strategy? Those issues are not well illuminated by the results of this study, but the conclusions may provide a basis for future work relating operations of SWP to its success or failure as a commercial entity.

In terms of the study of market behavior, a variety of extensions of this approach may be possible. A next step empirical study would be to estimate more complex games and include more players and more products under different regulatory systems. This analysis could also be extended by looking at off-board grains and specialty crops handled by the elevator system, including testing for both oligoposony pricing to farmers and oligopoly pricing for off-CWB grains to purchasers from the grain elevator system.

## NOTES

1. “We are the Canadian Wheat Board, the marketing agency for over 85,000 farmers who grow wheat, durum wheat and barley in Western Canada. Our role is to market these grains for the best possible price both within Canada and around the world. Sales revenues earned, less marketing costs, are passed back to western Canadian farmers. With annual sales revenue between \$4 and \$6 billion, the CWB is one of Canada’s biggest exporters and one of the world’s largest grain-marketing organizations. Annually, we sell more than 20 million tons of wheat and barley to over 70 countries. A 15-member Board of Directors controls the CWB, with 10 directors elected by western Canadian farmers and five appointed by the federal government. The CWBs value to farmers is based on three pillars: single-desk selling; price pooling; and the government guarantee.” *Source:* <http://www.cwb.ca/en/about/index.jsp>, accessed on September 1, 2005.

2. SWP Press Release: [http://www.swp.com/inv\\_files/CapMkts/nr-Feb7.pdf](http://www.swp.com/inv_files/CapMkts/nr-Feb7.pdf), accessed on September 1, 2005.

3. The concentration level is measured using the concentration ratio (CR). CR1 represents the market share for the top company; CR2 represents the market share for the top two companies, and so forth.

4. The market share of UGG in wheat handling in the Saskatchewan region varied from about 6% to 13% over the period, whereas that of Cargill Limited varied from 3% to 7% approximately. The market share is calculated based on wheat delivery to primary elevators by licensed companies in the region.

5. Elevation charges including receiving, elevating, and loading out wheat and additional charges, which are deflated using Consumer Price Index in the model estimations.

6. Turnover is calculated as the receipts divided by the capacity of an elevator.

7. In fact, when regressing the deflated minimum elevation tariff charged in the region over the period on a time trend, the time trend effect is small. The estimated deflated tariff =  $8.13 - 0.05 \times t$ , and the  $t$ -ratios for the constant and slope are 38.23 and  $-3.84$  respectively.

8. In fact, first-order autocorrelation corrected versions of models are also estimated and the estimated Rhos are found to be not statistically significant.

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## REFERENCES

- Agriculture and Agri-food Canada (2004). Grain handling and transportation reports: A Study of the Canadian Wheat Board’s Role in Grain Transportation, Online, retrieved from <http://www.agr.gc.ca/mad-dam/e/winne/cwb1e.pdf>, accessed September 1, 2005.

- Askin, T. (1988). *The cost of grade segregations to primary elevators: Final report*. Winnipeg: Canadian Grain Commission.
- Bateman, D. I., Edwards, J. R., & LeVay, L. (1979). Problems of defining a co-operative as an economic organization. *Oxford Agrarian Studies*, 8, 53–62.
- Benoit, J., & Krishna, V. (1987). Dynamic duopoly: Prices and quantities. *The Review of Economic Studies*, 54(1), 23–45.
- Canadian Grain Commission (1980–2005a). *Summary of licensed primary elevator tariffs*. Winnipeg: Canadian Grain Commission.
- Canadian Grain Commission (1980–2005b). *Grain elevators in Canada*. Winnipeg: Canadian Grain Commission.
- Canadian Grain Commission (1980–2005c). *Grain deliveries at Prairie points*. Winnipeg: Canadian Grain Commission.
- Canadian Grain Commission (1980–2005d). *Annual report*. Winnipeg: Canadian Grain Commission.
- Carlton, D. W., & Perloff, J. (2000). *Modern industrial organization* (3rd ed.). Addison-Wesley.
- Cotterill, R. (1986). Market power in the retail food industry: Evidence from Vermont. *Review of Economics and Statistics*, 68, 379–386.
- Co-operatives Secretariat. (2004). Co-operatives in Canada. Agriculture and Agri-Food Canada, Online, retrieved from <http://www.agr.gc.ca/policy/coop>, accessed September 1, 2005.
- Enke, S. (1945). Consumer co-operatives and economic efficiency. *American Economic Review*, 35(1), 148–155.
- Fulton, M. (1989). Co-operatives in oligopolistic industries: The western Canadian fertilizer industry. *Journal of Agricultural Cooperation*, 4, 1–20.
- Fulton, M. (2001). Economics of Co-operatives, Class Notes Economics 231.3. Center for the Study of Co-operatives. Saskatoon, SK: University of Saskatchewan.
- Fulton, M., & Giannakas, K. (2001). Organizational commitment in a mixed oligopoly: Agricultural co-operatives and investor-owned firms. *American Journal of Agricultural Economics*, 83(5), 1258–1265.
- Gasmi, G., & Vuong, Q. H. (1991). An econometric analysis of some duopolistic games in prices and advertising. In: G. F. Rhodes (Ed.), *Advances in econometrics: Econometric methods and models for industrial organizations* (Vol. 9, pp. 225–254). London, England: JAI Press Inc.
- Goddard, E. (2002). Factors underlying the evolution of farm-related co-operatives in Alberta. *Canadian Journal of Agricultural Economics*, 50(4), 473–495.
- Goddard, E., Boxall, P., & Lerohl, M. (2002). Co-operatives and the commodity political agenda: A political economy approach. *Canadian Journal of Agricultural Economics*, 50(4), 511–526.
- Huang, W. (2004). *The impacts of the acquisition of Dairyworld by Saputo on fluid milk sales and prices in western Canada*. Unpublished paper, Department of Rural Economy, University of Alberta.
- Kadiyali, V., Vilcassim, N. J., & Chintagunta, P. K. (1996). Empirical analysis of competitive product line pricing decisions: Lead, follow, or move together? *The Journal of Business*, 69(4), 459–487.
- Kreps, D., & Scheinkman, J. (1983). Cournot pre-commitment and Bertrand competition yield Cournot outcomes. *Bell Journal of Economics*, 14, 326–337.

- Pollak, R. A., & Wales, T. J. (1991). The likelihood dominance criterion: A new approach to model selection. *Journal of Econometrics*, 47(2-3), 227-242.
- Rhodes, V. J. (1983). The large agricultural co-operative as a competitor. *American Journal of Agricultural Economics*, 65(5), 1090-1095.
- Rogers, R. T., & Sexton, R. J. (1994). Assessing the importance of oligopsony power in agricultural markets. *American Journal of Agricultural Economics*, 76(5), 1143-1150. Saskatchewan Wheat Pool. Various. *Annual Report*.
- Roy, A. D., Hanssens, D. M., & Raju, J. S. (1994). Competitive pricing by a price leader. *Management Science*, 40(7), 809-823.
- Saskatchewan Wheat Pool. (2005). *Pool's Board approves a recapitalization plan and proposed \$150 million rights offering*. Immediate Release. February 7.
- Scheinkman, J. A., & Schechtman, J. (1983). A simple competitive model with production and storage. *The Review of Economic Studies*, 50(3), 427-441.
- Sexton, R. (1990). Imperfect competition in agricultural markets and the role of co-operatives: A spatial analysis. *American Journal of Agricultural Economics*, 72(3), 709-720.
- Sexton, R. J. (1986). The formation of cooperatives: A game-theoretic approach with implications for cooperative finance, decision making, and stability. *American Journal of Agricultural Economics*, 68, 214-225.
- Shank, B. (2004). *Pricing games in poultry sector: The case of eggs in Australia and Chicken in Canada*. Unpublished Masters Thesis. Department of Rural Economy. University of Alberta.
- Singh, N., & Vives, X. (1984). Price and quantity competition in a differentiated duopoly. *The RAND Journal of Economics*, 15(4), 546-554.
- Taylor, R. A. (1971). The credit union as a co-operative institution. *Review of Social Economy*, LIV, 89-98.
- University of Saskatchewan Archives and the Centre for the Study of Co-operatives. (2005). Saskatchewan Wheat Pool: Chronology of Events, retrieved from [http://scaa.usask.ca/gallery/wheatpool/en\\_chrono.php](http://scaa.usask.ca/gallery/wheatpool/en_chrono.php), accessed on September 1, 2005.
- Vickner, S. S., & Davies, S. P. (2004). Estimating strategic price response in a product-differentiated oligopoly: The case of a domestic canned fruit industry. *Agribusiness*, 16(2), 125-140.
- Vuong, Q. H. (1989). Likelihood ratio test for model selection and non-nested hypothesis. *Econometrica*, 57(2), 307-334.
- Wohlgenant, M. (1993). Distribution of gains from research and promotion in multi-stage production systems: The case of the U.S. beef and pork industries. *American Journal of Agricultural Economics*, 75(3), 642-651.



## APPENDIX A. HISTORY OF TRANSACTIONS OF SASKATCHEWAN WHEAT POOL

Year	Events/status	Comments
1924	The former SWP, Saskatchewan Cooperative Wheat Producers, begins operation	It had 45,725 farmers and acreage of 6.3 million
1925	The first elevator opens at Bulyea	
1928	Membership in the Saskatchewan, Alberta and Manitoba Wheat pools totals 140,000. The three pools own 1,642 elevators in total	SWP is referred to as the biggest business in Canada, together with Alberta and Manitoba Wheat pools, with a turnover of \$323 million
1929–1930	World wheat prices drop dramatically, and the Pools have huge debts	Bankruptcy avoided when government guarantees bank loans. It takes SWP two decades to pay the debts
1931	<i>The Western Producer</i> newspaper is acquired	
1935	Canadian Wheat Board established. Three Pools operate within their own provincial borders	
1940s	Saskatchewan Cooperative Livestock Producers amalgamated with the SWP. In 1949, the Saskatoon flour mill is completed, with a capacity of 2,000 cwt. of flour per day	
1957	SWP purchases Terminal Number 6 at Thunder Bay from the CNR	This was a milestone for SWP
1962	SWP builds the largest country elevator in its system with a new style 140,000 bushel unit at Leask	
1963	Farm supplies department is established, linked with country elevator system	
1968	New grain terminal constructed at North Vancouver	
1970	XCAN Grain is formed	
1975	CSP Foods Ltd. begins processing oilseeds plus manufacturing, packaging and marketing oilseeds products	
1976	CSP establishes a Product Development Section	

**APPENDIX A. (Continued)**

Year	Events/status	Comments
1987	Builds the first SWP concrete elevator, with 8,000-ton capacity, at Luseland. Activities of affiliated companies: Buys 25% of Northco Foods (Robin’s Donuts). Invests in Philom Bios. Because of deregulation and changes to Crowsnest Pass Rate, SWP turns to subsidiaries to supplement revenue lost in grain handling	SWPs profit began to decline about 1982. Low grain prices coupled with drought years cited as by SWP managers as reason for the decline
1988–1989	Proposal to merge the three western grain pools. The concept fails. Activities of affiliated companies: Acquires 90% of a graphics company, merging it with Modern Press. Cost \$6.4 million	Pool estimates volume decrease of 33%
1990	Activities of affiliated companies: Invests \$3.1 million to acquire 49% of Prairie Malt Ltd., 25% share in Northco, 90% of E.H. Pope Bakery Ltd., 65% of Stockmen’s Exchange Ltd. Forms AgPro Grain Ltd. from purchase of Elders Grain of Canada and Northern Sales	Cited by SWP as a key investment in adding value to prairie farm products and supporting community development
1991	Activities of affiliated companies: Enters a joint venture to process and market borage. Becomes a partner in Lanigan feedlot and ethanol plant (Pound-maker Agventures Ltd)	
1992	Activities of affiliated companies: Acquires partnership in CanAmera Foods Ltd. Creates PrintWest Communications Ltd	
1994	Activities of affiliated companies: Creates Heartland Livestock Services with MPE. Expands InfraReady Products and Dawn Foods Canada Introduces a truck-mounted elevator to improve grain logistics	

### APPENDIX A. (*Continued*)

Year	Events/status	Comments
1995	SWP begins to upgrade to replace the small country elevators in its network, reinforces its growth strategy of diversification into related agribusiness to secure high returns. Millions of dollars are spent on facility upgrades and SWP announces plan to shut 100 local elevators over three years	Prairie grain handling becomes increasingly competitive without Crowsnest Pass Rate.
1996	The Crowsnest Pass Agreement grain transportation rates are abolished. SWP debuts on the TSX, becoming a partially publicly traded company	
1997–98	Spends \$195 million on 16 high-throughput grain handling and marketing centers, plus \$40 million for 6 grain condo/terminals. Many local elevators are closed. Expands AgPro, starts joint venture projects elsewhere including Poland, Mexico. Activities by affiliated companies: Invests in a US bakery supply company, meat processing operations, a British-based grain trader, farm input dealerships, feed mills, special crop processors, and pet-food manufacturers. Total assets top \$1.2 billion, up from \$750 million in 1992	Long-term debt increases to \$200 million, up from 1991's level of \$65 million. With net earnings of \$47 million, a debt-equity ratio of 36:64, and rising share prices. SWP expresses optimism.
1998	Agricore is formed by a merger of AWP and MPE. SWP announces closure of additional 170 elevators	
1999	SWP builds 11 grain handling and marketing facilities; acquires an inland terminal in Northgate, North Dakota (with General Mills, Inc.); jointly opens an import terminal at Manzanillo, Mexico; invests in an import terminal in Gdansk, Poland; and Agpro opens first Alberta and Manitoba terminals	

**APPENDIX A. (Continued)**

Year	Events/status	Comments
2000	SWP builds eight grain handling and marketing facilities. Sells many of assets recently acquired, including Robin's Foods, Inc., SWP Matrix Ltd., Agro-Pacific Industries Ltd. (write-off), interest in XCAN Grain Pool Ltd, Heartland Livestock Services, Premium Brands, Inc., interest in CanAmera, and CSP Foods Division. 75 managers and 200 employees are eliminated. 63 more elevators are closed	By 2000, debts total more than \$1 billion. The debt to equity ratio is 60:40. Total assets are \$1.6 billion
2001–2002	Agricore merges with UGG to create Agricore-United, making SWP Canada's second-largest grain elevator system SWP completes sale of its interest in Heartland Liverstock Service, Western Producer Publications, CSP Foods Division, CanAmera Food, Western Cooperative Fertilizers Ltd, four feed mills and a retail operation office	The divested activities generate \$154 million to pay down debt
2003	SWP announces bankruptcy, a last minute debt restructuring plan revealed in February. Loss of \$34 million in the first half of the year and \$16 million in the second half of the year	Ship 4.8 million tons of grains and oilseeds, down 35% from the previous year due to drought in 2002
2004	Upgrade Vancouver terminal to enhance its railway receiving system thereby increasing throughput capacity and speed by up to 20 percent	The Pool generates \$5 million profit, the Pool's first bottom line net income since 1998
2005	SWP announced plans to become an investor-owned firm	

*Sources:* Saskatchewan Wheat Pool, Annual Report, Various; University of Saskatchewan Archives and the Centre for the Study of Co-operatives, 2005.

**APPENDIX B. ALGEBRAIC SPECIFICATION OF  
DEMAND AND PRICE REACTION FUNCTIONS FOR  
VARIOUS GAMES**

*The Phrase Bertrand Model 1 – SWP Behaves as a Cooperative,  
Treated as a Cooperative*

$$\begin{aligned} \text{qswp}_t = & d_1 + a_1\text{pswp}_t + b_1\text{ppg}_t + e_1\text{pswp}_{t-1} \\ & + k_1\text{time}_t + l_1\text{policy}_t + i_1\text{capswp}_t + j_1\text{exp tp}_t \end{aligned} \quad (\text{B.1})$$

$$\begin{aligned} \text{qpg}_t = & d_2 + a_2\text{pswp}_t + b_2\text{ppg}_t + e_2\text{ppg}_{t-1} \\ & + k_2\text{time}_t + l_2\text{policy}_t + i_2\text{cappg}_t + j_2\text{exp tp}_t \end{aligned} \quad (\text{B.2})$$

$$\text{pswp}_t = \text{MC}_1 \quad (\text{B.3})$$

$$\begin{aligned} \text{ppg}_t = & -\frac{1}{2b_2}(d_2 + e_2\text{ppg}_{t-1} + k_2\text{time}_t + l_2\text{policy}_t \\ & + i_2\text{cappg}_t + j_2\text{exptp}_t) + 0.5\text{MC}_2 - \frac{a_2}{2b_2} \times \text{MC}_1 \end{aligned} \quad (\text{B.4})$$

*The Phrase Bertrand Model 2 – SWP Behaves as an IOF, Treated as an IOF*

$$\begin{aligned} \text{qswp}_t = & d_1 + a_1\text{pswp}_t + b_1\text{ppg}_t + e_1\text{pswp}_{t-1} + k_1\text{time}_t \\ & + l_1\text{policy}_t + i_1\text{capswp}_t + j_1\text{exp tp}_t \end{aligned} \quad (\text{B.5})$$

$$\begin{aligned} \text{qpg}_t = & d_2 + a_2\text{pswp}_t + b_2\text{ppg}_t + e_2\text{ppg}_{t-1} + k_2\text{time}_t \\ & + l_2\text{policy}_t + i_2\text{cappg}_t + j_2\text{exp tp}_t \end{aligned} \quad (\text{B.6})$$

$$\begin{aligned} \text{pswp}_t = & -\frac{1}{2a_1}(d_1 + b_1\text{ppg}_t + e_1\text{pswp}_{t-1} + k_1\text{time}_t \\ & + l_1\text{policy}_t + i_1\text{cappg}_t + j_1\text{exp tp}_t) + 0.5\text{MC}_1 \end{aligned} \quad (\text{B.7})$$

$$\begin{aligned} \text{ppg}_t = & -\frac{1}{2b_2}(d_2 + a_2\text{pswp}_t + e_2\text{ppg}_{t-1} + k_2\text{time}_t \\ & + l_2\text{policy}_t + i_2\text{cappg}_t + j_2\text{exp tp}_t) + 0.5\text{MC}_2 \end{aligned} \quad (\text{B.8})$$

*The Phrase Stackelberg Model 1 – SWP Behaves as an IOF,  
Treated as an IOF, PG Leads*

$$\begin{aligned} \text{qswp}_t &= d_1 + a_1\text{pswp}_t + b_1\text{ppg}_t + e_1\text{pswp}_{t-1} + k_1\text{time}_t \\ &\quad + l_1\text{policy}_t + i_1\text{capswp}_t + j_1\text{exp tp}_t \end{aligned} \tag{B.9}$$

$$\begin{aligned} \text{qpg}_t &= d_2 + a_2\text{pswp}_t + b_2\text{ppg}_t + e_2\text{ppg}_{t-1} + k_2\text{time}_t \\ &\quad + l_2\text{policy}_t + i_2\text{cappg}_t + j_2\text{exp tp}_t \end{aligned} \tag{B.10}$$

$$\begin{aligned} \text{pswp}_t &= -\frac{1}{2a_1}(d_1 + b_1\text{ppg}_t + e_1\text{pswp}_{t-1} + k_1\text{time}_t \\ &\quad + l_1\text{policy}_t + i_1\text{cappg}_t + j_1\text{exp tp}_t) + 0.5\text{MC}_1 \end{aligned} \tag{B.11}$$

$$\begin{aligned} \text{ppg}_t &= -\frac{1}{2b_2 - a_2b_1/a_1} \left[ \left( d_2 - \frac{a_2d_1}{2a_1} - \frac{a_2e_1}{2a_1}\text{pswp}_{t-1} \right. \right. \\ &\quad - \frac{a_2k_1}{2a_1}\text{time}_t - \frac{a_2l_1}{2a_1}\text{policy}_t - \frac{a_2i_1}{2a_1}\text{capswp}_t - \frac{a_2j_1}{2a_1}\text{exp tp}_t \\ &\quad + e_2\text{ppg}_{t-1} + k_2\text{time}_t + l_2\text{policy}_t + i_2\text{cappg}_t + j_2\text{exp tp}_t \Big) \\ &\quad \left. - \text{MC}_2 \left( b_2 - \frac{a_2b_1}{2a_1} \right) + \text{MC}_1 \frac{a_2}{2} \right] \end{aligned} \tag{B.12}$$

*The Phrase Stackelberg Model 2 – SWP Behaves as an IOF,  
Treated as an IOF, SWP Leads*

$$\begin{aligned} \text{qswp}_t &= d_1 + a_1\text{pswp}_t + b_1\text{ppg}_t + e_1\text{pswp}_{t-1} + k_1\text{time}_t \\ &\quad + l_1\text{policy}_t + i_1\text{capswp}_t + j_1\text{exp tp}_t \end{aligned} \tag{B.13}$$

$$\begin{aligned} \text{qpg}_t &= d_2 + a_2\text{pswp}_t + b_2\text{ppg}_t + e_2\text{ppg}_{t-1} + k_2\text{time}_t \\ &\quad + l_2\text{policy}_t + i_2\text{cappg}_t + j_2\text{exp tp}_t \end{aligned} \tag{B.14}$$

$$\begin{aligned} \text{pswp}_t &= -\frac{1}{2a_1 - b_1a_2/b_2} \left[ \left( d_1 - \frac{b_1d_2}{2b_2} - \frac{b_1e_2}{2b_2}\text{ppg}_{t-1} - \frac{b_1k_2}{2b_2}\text{time}_t \right. \right. \\ &\quad \left. \left. - \frac{b_1l_2}{2b_2}\text{policy}_t - \frac{b_1i_2}{2b_2}\text{cappg}_t - \frac{b_1j_2}{2b_2}\text{exp tp}_t \right. \right. \end{aligned}$$

$$\begin{aligned}
 &+e_1pswp_{t-1} + k_1time_t + l_1policy_t + i_1cappg_t + j_1exp\ tp_t) \\
 &-MC_1\left(a_1 - \frac{b_1a_2}{2b_2}\right) + MC_2\frac{b_1}{2}\Big] \\
 ppg_t = &-\frac{1}{2b_2}(d_2 + a_2pswp_t + e_2ppg_{t-1} + k_2time_t \\
 &+ l_2policy_t + i_2cappg_t + j_2\ exp\ tp_t) + 0.5MC_2 \quad (B.16)
 \end{aligned}$$

### APPENDIX C. COMPARING WHEAT HANDLING CAPACITY AND NUMBER OF ELEVATORS, SASKATCHEWAN

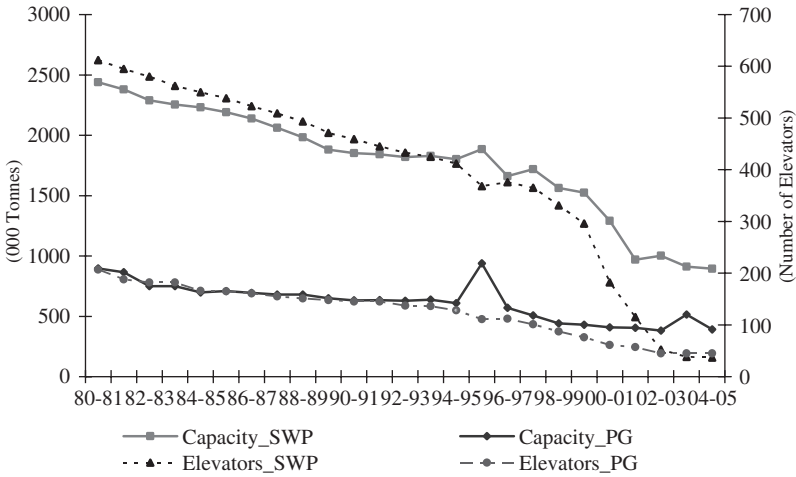


Fig. C1. Comparison of Wheat-Handling Capacity and Number of Elevators Between SWP and PG in Saskatchewan (1980-2005).

**PART II:**  
**THEORETICAL STUDIES**



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# COOPERATION AND EFFORT, RECIPROCITY AND MUTUAL SUPERVISION IN WORKER COOPERATIVES

Roger A. McCain

## ABSTRACT

*This paper formalizes the determination of effort in work teams as a social dilemma, adding a mutual-monitoring activity and reciprocity motivations to the formal model of effort provision in cooperatives. It turns out that the cooperative solution is viable in a work group in which the workers frame effort as a reciprocal gift, and if they do frame effort in this way in worker cooperatives, this could explain the observed tendency of cooperatives to attain higher productivity.*

## 1. INTRODUCTION

A worker cooperative is an association of labor suppliers that operates according to the cooperative principles as set out by the [International Cooperative Alliance \(1995\)](#) and thus a democratic enterprise in which “control rights follow from membership in the firm’s workforce and

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ownership by itself confers no decision-making rights” (Bonin, Jones, & Putterman, 1993, p. 1307; note also McCain, 2006a). While economic theorists have assumed that enterprises of this kind would have the same or lower productivity than conventional firms (e.g. Jensen & Meckling, 1979), many empirical studies have found that worker cooperatives have higher factor-neutral productivity (Bonin et al., 1993; Doucouliagos, 1995). This view, however, is usually expressed intuitively, rather than in formal models (McCain, 1980 is an exception). Moreover, some empirical studies note that, in the cooperatives that were observed, the workers supervise one another, and less is spent on supervision than is spent by comparable conventional firms (despite the fact that the cooperatives attain higher productivity) (Craig & Pencavel, 1993; Berman, 1967; Bellas, 1972; Bernstein, 1976; Cable & Fitzroy, 1980; Bartlett, Cable, Estrin, Jones, & Smith, 1992, *inter alia*).

This paper reconsiders the theory of effort provision in cooperatives, incorporating some recent experimental evidence on non-self-interested motives of reciprocity that seem to be quite common to human beings (McCabe, Rassenti, & Smith, 1996; Fehr & Fischbacher, 2004; Levine, 1998, e.g.). The intuitive theoretical prediction of lower productivity in cooperatives does not seem to have been formalized in the literature, so a first step is to formalize that theory, treating it as a social dilemma. The paper then gives a brief review of the experimental literature on reciprocity, particularly in the context of social dilemmas. The formal model is then extended to incorporate mutual monitoring based on reciprocity.

## 2. AN EFFORT DILEMMA

In this paper we take some perspectives from game theory, so it will be necessary to distinguish two uses of the term “cooperative.” A fundamental dichotomy of game theory is between noncooperative and cooperative solutions to games. In a noncooperative solution, there may be unrealized potential for the participants all to increase their payoffs by forming a binding agreement to coordinate their strategies. This is illustrated by the well-known Prisoner’s Dilemma (McCain, 2004a, Chapter 3). In a cooperative solution, by contrast, any coalition of participants that can improve their payoffs by forming a binding agreement are assumed to do so. Is there any consilience between cooperative enterprises and cooperative solutions of games? To some extent there must be. The *International Cooperative Alliance defines* (1995) a cooperative<sup>1</sup> as an “association of persons united voluntarily to meet their common economic, social, and cultural needs,”

and as such, like any enterprise, it is a coalition in the sense of cooperative game theory. But there is a little more to it than that. Among the fundamental cooperative values are “equality, equity, and solidarity” (*International Cooperative Alliance, 1995*). These values are not necessarily represented in cooperative game theory. While there are a number of concepts of cooperative solution in game theory, such a solution must, at a minimum, be efficient in the Paretian sense. Equity may or may not be imposed, and some such solution concepts rely on assumptions that might best be called coalitional egoism (*McCain, 2004a, Chapters 12 and 13*). Nevertheless, cooperative game theory may help us to capture one fundamental aspect of cooperative enterprise, namely mutuality or mutual benefit.

Critics of worker cooperatives from the property rights school of thought generally assume that effort and labor productivity will be lower in worker cooperatives than in capitalist firms (*Furubotn & Pejovich, 1970; Furubotn, 1976, 1980; Carson, 1977; Jensen & Meckling, 1979*). The intuition behind the theoretical prediction of lower productivity can be stated this way: a conventional capitalist firm, driven by the imperative to intensify the exploitation of labor, will employ supervisors and extract more effort from the employees than will a worker-cooperative not moved by that imperative. In effect, they treat effort determination as a noncooperative game and argue that conventional capitalist firms (more nearly) realize the cooperative equilibrium and worker cooperatives do not. Thus, it seems, the property rights school identify cooperatives with a noncooperative equilibrium. While this may seem odd, it is not a logical failure, since cooperative (in the sense of the cooperative principles) and cooperative (in the game theoretic sense) simply are two different terms. It may, however, be oversimplified either in its conception of effort determination, or of human motivation, or both.

This section of the paper will formalize the game of effort determination as an effort dilemma. The following section will characterize a broad class of cooperative solutions to this game and in following section this result will be contrasted with the noncooperative solution of the same game.

We consider a group of  $N$  workers affiliated in a workers' cooperative enterprise. The coalition (cooperative enterprise) can control the hours of work but not the effort commitment of the individual worker. The workers' income (wages, salary, dividends) is the residual after paying for nonlabor inputs out of sales revenue. There are  $N$  workers and hours per week are uniform at  $h$  per worker, so the coalition uses  $Nh$  labor hours, the labor-time input to production. The average effort per worker is  $e$ . We consider a short run in which there are no other variable inputs and so the production

function is

$$Q = f(Nh, e) \quad (1)$$

where  $Q$  is the output per period of the cooperative enterprise. If  $e_i$  is the effort commitment of agent  $i$  then

$$e = \frac{\sum_{i=1}^N e_i}{N} \quad (2)$$

The self-interested gain of agent  $i$  – his utility, in conventional economic terms – is

$$U_i = g_i(h, w, e_i) \quad (3)$$

where  $w$  is the uniform income per worker in the cooperative. As indicated,  $w$  is a residual, that is

$$w = \frac{(pQ - F)}{N} \quad (4)$$

Notice that this model assumes that there is no spending or resource commitment to supervision or monitoring, or (pace Furubotn and Pejovich) that such spending is entirely ineffective. This is an extreme assumption meant to characterize a pure case, and indeed a worst case for productivity in cooperatives. In actual fact, cooperatives do spend on supervision. We might then explore a model that does incorporate spending on supervision, and compare the level of such spending and its implications in the case of a cooperative by comparison with the case of a profit-seeking firm. This is done in [McCain \(2006b\)](#). The finding is that *ceteris paribus* (and using the neoclassical model of utility maximization) there is no difference – both forms of enterprise would supervise to the same degree. This suffices to refute the informal reasoning of Furubotn and Pejovich and their followers; but leaves the observed productivity advantage of cooperatives unexplained.

We now characterize the effort commitments that correspond to a cooperative solution to this game.

### 3. A FULLY COOPERATIVE SOLUTION

While there are several conceptions of cooperative solutions to games, all assume that the solution is Pareto-efficient, so the necessary conditions for a Pareto-optimum cooperative solution are necessary conditions for any cooperative solution. These necessary conditions will serve to contrast

cooperative and noncooperative outcomes. To characterize Pareto-efficient hours, effort and payment, we

$$\max_{h,w,e,e_i} \sum_{i=1}^N \lambda_i g_i(h, w, e_i) \quad \text{subject to } 1, 2, 4 \quad (5)$$

Here, the variables  $\lambda_i$  are distributional weights,<sup>2</sup> and may take any positive value. The social maximand therefore, is a weighted average utility per worker, with arbitrary weights. Of course, the case of equal weights is of particular interest. Table 1 gives the Lagrangean function and necessary conditions for a maximum.

Assuming an interior solution and that all constraints are binding, T.1.2 and T.1.3 together yield

$$p \frac{\partial f}{\partial Nh} = - \frac{\sum_{i=1}^N \lambda_i (\partial g_i / \partial h)}{\sum_{i=1}^N \lambda_i (\partial g_i / \partial w)} \quad (5A)$$

The interpretation of this condition may be more clear if we impose the simplifying assumptions that the cooperative is utilitarian and egalitarian and that the agents are identical, so that  $g_i(\dots) = g_j(\dots)$  and  $\lambda_i = \lambda_j, i \neq j$ . Without loss of generality  $\sum_{i=1}^N \lambda_i = 1$ . Then Eq. (5A) becomes

$$p \frac{\partial f}{\partial Nh} = - \frac{\partial g / \partial h}{\partial g / \partial w} \quad (5A^*)$$

and Eq. (5A\*) says that the cooperative sets the value of the marginal product of labor to its (uniform) marginal rate of substitution of income for leisure. Eq. (5A) substitutes the more complex condition that the

**Table 1.** Necessary Conditions for Cooperative Effort, Hours and Pay.

---

T.1.1.	$L = \sum_{i=1}^N \lambda_i g_i(h, w, e_i) + \mu^* \left[ pf(Nh, e) - F \right] \frac{1}{N} - w \Big] + v \left[ \frac{1}{N} \sum_{j=1}^N e_j - e \right]$
T.1.2.	$\frac{\partial L}{\partial h} = \sum_{i=1}^N \lambda_i \frac{\partial g_i}{\partial h} + \mu p \frac{\partial f}{\partial Nh} \leq 0$
T.1.3.	$\frac{\partial L}{\partial w} = \sum_{i=1}^N \lambda_i \frac{\partial g_i}{\partial w} + \mu \leq 0$
T.1.4.	$\frac{\partial L}{\partial e_i} = \lambda_i \frac{\partial g_i}{\partial e_i} + \frac{v}{N} \leq 0$
T.1.5.	$\frac{\partial L}{\partial e} = \mu p \frac{\partial f}{\partial e} \frac{1}{N} - v \leq 0$

---

cooperative sets the value of the marginal product of labor to a distributionally weighted average marginal rate of substitution.

From the necessary conditions in Table 1 we also obtain

$$p \frac{\partial f}{\partial e} = - \left[ \frac{N \lambda_i (\partial g_i / \partial e_i)}{\sum_{j=1}^N \lambda_j (\partial g_j / \partial w)} \right] N \quad (5B)$$

Once again the condition will be clearer if we impose the simplifying assumptions of a uniform membership and an egalitarian–utilitarian decision criterion. We then have

$$p \frac{\partial f}{\partial e} = - \frac{N \lambda \partial g / \partial e}{N \lambda \partial g / \partial w} N = - \frac{\partial g / \partial e}{\partial g / \partial w} N \quad (5B^*)$$

This equation states that the cooperative sets the value of the marginal product of the public good average effort equal to the individual marginal rate of substitution weighted by the  $N$  members who must each share the disutility of the common average effort. The multiplier  $N$  in the numerator of equation Eq. (5B) corrects for the fact that the denominator accumulates the weighted utility of income of the membership as a whole.

#### 4. NONCOOPERATIVE EFFORT SUPPLY

Now we consider noncooperative effort supply in the case of wholly self-interested members. To be exact, the solution is neither wholly cooperative nor noncooperative, since the cooperative is a coalition and can determine one aspect of the common strategy, the hours of work, cooperatively. Thus, we have a “semi-effective game” in the terms of McCain, 2004b (See also McCain, 2006b). The cooperative determines its “policy,”  $h$ , while the individual members play a noncooperative game in the determination of effort treating  $h$  as a given parameter. The individual worker acting independently will

$$\max_{w, e, e_i} g_i(h, w, e_i) \quad \text{subject to } 1, 2, 4 \quad (6)$$

For a Nash equilibrium, the effort commitments  $e_j$ ,  $j \neq i$ , are treated as given. Note that since the individual’s effort commitment influences  $e$  and thus the residual wage  $w$ , these cannot be taken as given in the individual’s maximization program. Therefore, these variables are among the agent’s instrument variables; but they are subject to constraint. For  $e$  the constraint is  $e \leq (1/N) \sum_{j=1}^N e_j$ , with  $e_j$  given for  $j \neq i$ . This expresses (1)

**Table 2.** Necessary Conditions for Individual Noncooperative Effort and Pay.

---

T.2.1.	$L = g_i(h, w, e_i) + \mu \left[ pf(Nh, e) - F \right] \frac{1}{N} - w \Big] + v \left[ \frac{1}{N} \sum_{j=1}^N e_j - e \right]$
T.2.2.	$\frac{\partial L_i}{\partial w} = \frac{\partial g_i}{\partial w} + \mu \leq 0$
T.2.3.	$\frac{\partial L_i}{\partial e_i} = \frac{\partial g_i}{\partial e_i} + \frac{v}{N} \leq 0$
T.2.4.	$\frac{\partial L_i}{\partial e} = \mu p \frac{\partial f}{\partial e} \frac{1}{N} - v \leq 0$

---

that the individual can influence  $e$  only by changing his own effort, and (2) that the benefits of such an increase are shared by all members, i.e., agent  $i$ 's effort is a public good. The constraint for  $w$  is  $w \leq (pf(Nh, e) - F)(1/N)$ , with  $p, h, N$  and  $F$  given. This expresses that the individual can influence his pay by influencing average effort, which (as the previous constraint expresses) can itself only be influenced indirectly via the public good mechanism. The Lagrangean function and necessary conditions are shown in Table 2.

Again we assume that the solution is interior and all constraints hold as equalities. These conditions and assumptions yield

$$p \frac{\partial f}{\partial e} = - \frac{\partial g_i / \partial e_i}{\partial g_i / \partial w} N^2 \tag{6A}$$

To contrast this with the previous result, once again assume that the agents are identical. Then we have

$$p \frac{\partial f}{\partial e} = - \frac{\partial g / \partial e}{\partial g / \partial w} N^2 \tag{6B}$$

alternatively

$$\frac{p(\partial f / \partial e)}{N} = - \frac{\partial g_i / \partial e_i}{\partial g_i / \partial w} N \tag{6B*}$$

Comparing Eq. (5B\*) with Eqs. (6B) or (6B\*), we see that the individual's independent decision process considers the number of members twice, in that (from the individual's point of view) although the effort is shared, the individual gets only  $1/N$  of the benefit generated by her own effort.

The idea behind this comparison is illustrated by Fig. 1. In the figure, average effort is on the horizontal axis and the total money payment to



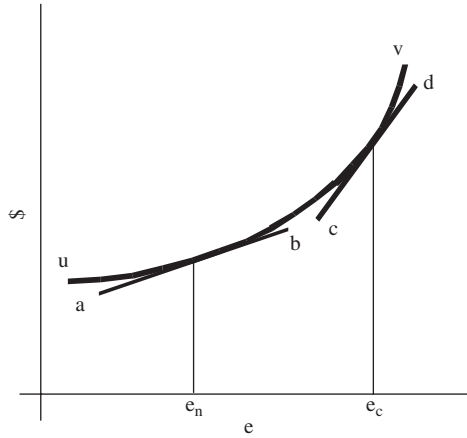


Fig. 1. An Effort-Pay Trade-off.

compensate the workforce for increased effort, keeping them all at a given utility level as effort increases, on the vertical axis. Curve  $uv$  is a collective indifference curve in the sense that movements along the curve leave all agents at unchanged utility levels. Let the slope of line  $cd$  be  $p(\partial f/\partial e)$  and  $e_c$  the cooperative effort level. If, then, the slope of  $ab$  is  $p(\partial f/\partial e)/N$ , then (abstracting from income effects)  $e_n$  is the noncooperative effort level.

This implies – very much as the property rights school view of worker cooperatives would hold – that the unsupervised workers will under-allocate effort. Since this analysis applies to *any* production coalition without effort monitoring, we should probably say that the proposition applies *no less* to cooperatives than to investor and state controlled enterprises.

The joint determination of hours,  $h$ , is the cooperative part of this model. The objective, as in Eq. (5), will be

$$\max_{h,w} \sum_{i=1}^N \lambda_i g_i(h, w, e_i) \quad \text{subject to } 1, 2, 4 \tag{7}$$

Anticipating the members’ noncooperative effort supply, the cooperative will treat  $e$  and  $e_i$  as constants given by the Nash equilibrium among the members. Table 3 gives the Lagrangean function and necessary conditions for this decision.

These conditions yield, again, Eq. (5A).

**Table 3.** Necessary Conditions for Hours and Pay.

---

T.3.1	$L = \sum_{i=1}^N \lambda_i g_i(h, w, e_i) + \mu^* \left[ pf(Nh, e) - F \right] \frac{1}{N} - w \Big] + v \left[ \frac{1}{N} \sum_{j=1}^N e_j - e \right]$
T.3.2	$\frac{\partial L_c}{\partial h} = \sum_{i=1}^N \lambda_i \frac{\partial g_i}{\partial h} + \mu^* p \frac{\partial f}{\partial Nh} \leq 0$
T.3.3	$\frac{\partial L_c}{\partial w} = \sum_{i=1}^N \lambda_i \frac{\partial g_i}{\partial w} + \mu^* \leq 0$

---

## 5. RECIPROCITY, SECOND AND THIRD PARTIES

There is a considerable literature of experimental game theory and a common result is that the predictions of noncooperative game theory are commonly not fully realized, though neither are those of simple cooperative game theory. This failure is often interpreted as evidence of non-self-interested motivation. Over the years, experiments have been made more sensitive to the details of motivational hypotheses, with the objective of discriminating among the distinct motivational hypotheses. Much recent work has focused on reciprocity, which means broadly that people will sacrifice their own self-interest to punish or retaliate against what they frame as unfavorable or aggressive behavior by others (negative reciprocity), and will sacrifice their own self-interest to reward what they frame as favorable or altruistic behavior by others (positive reciprocity). The key question then is, under what circumstances will agents frame the actions of others as unfavorable, aggressive, favorable or altruistic, and so as a stimulus to reciprocity? One possibility is that behavior may be seen as unfavorable or aggressive if it selfishly violates a social norm. In a social dilemma, such as an effort supply problem, it seems natural to identify the social norm with the cooperative solution of the game. This is the case of “cooperative norms” (Fehr & Fischbacher, 2004, p. 64).

Consider, for example, an experimental study by Fehr and Fischbacher. In this experiment, two subjects are each awarded points equivalent to 14.8 Swiss Francs. Each has the option of transferring the entire amount to the other subject or keeping it. Any amount transferred is tripled. The subjects are then given 5.55 Swiss Francs for participating in the game. This results in a Prisoner’s Dilemma game shown in Table 4.

In the experiments, however, this is just the first stage of the game. At the second stage (in some of the experiments) each party can allocate a part of

**Table 4.** An Experimental Prisoner's Dilemma.

		Player B	
		Transfer	Keep
Player A	Transfer	16.65, 16.65	5.55, 20.35
	Keep	20.35, 5.55	9.25, 9.25

their net payoff to purchase a reduction in the payoff to the other player. The purchase will reduce the other player's payoff by 3 Swiss Francs for every Franc spent. For example, suppose that Player A chose "keep" and Player B chose "transfer," leaving the payoffs 20.35 and 5.55, respectively. Player B might then spend 3 Francs to reduce Player A's payoffs by 9 Francs. The resulting payoffs would be 11.35 and 2.35, respectively. Since Player B has reduced her own payoffs from 5.55 to 2.55 Swiss Francs, this is against her self-interest. Self-interested players will not choose to buy reductions in the others' payoffs. (The game is played just once, not repeated). However, a player motivated by reciprocity and cooperative norms might act in this way. In fact, such behavior is often observed. Moreover, it will have an influence on the game, since reciprocal behavior can make the noncooperative strategy in the first stage unprofitable. A self-interested agent who anticipates reciprocity of a 9-Franc reduction in his payoffs will choose to cooperate.

However, reciprocity in this sense may not have a wide application in the real world. In effort dilemmas, in particular, "in cases of cooperative effort norms, a shirking individual imposes little cost on any particular other individual if work teams are sufficiently large" (Fehr & Fischbacher, 2004, p. 64). If, for example, John observes James shirking, John may not be perceptibly worse off as a result, and thus have no feeling of being personally wronged that would motivate him to punish James for his shirking, although John is aware that the total damage to himself and several hundred coworkers is perceptible. If John then punishes James anyway, perhaps by "putting him in Coventry" and so socially shunning James, John is responding mainly to the damage to third parties, the large body of coworkers.

Accordingly, Fehr and Fischbacher also, in some of their experiments, explore the frequency and impact of third-party punishment. "... we introduced a third-party punishment option into a PD [Prisoner's Dilemma] game, hereafter referred to as TP-PD. ... the TP-PD had two decision stages. In the first, Players A and B were each endowed with 10 points [equivalent to 3.7 Swiss Francs] and interacted with each other in a PD.

Player C observed A's and B's actions in Stage 1, and then had the opportunity to assign deduction points to A and/or B in Stage 2. Player C received an endowment of 40 points at the beginning of this stage (after not receiving any endowment in the first stage), which C could use to finance the assignment of deduction points. C could assign up to 20 deduction points to each of the two other players. As in all other experiments, assigning 1 deduction point cost C 1 point and cost the sanctioned player 3 points" (Fehr & Fischbacher, 2004, p. 72).

Here, again, Player C cannot impose any punishment without sacrificing her own interest by reducing her own payoffs. Nevertheless such decisions are often observed. Fehr and Fischbacher conclude "We ... found that sanctions by second parties directly harmed were much stronger than third-party sanctions, indeed strong enough to make norm violations unprofitable, whereas the sanctions of a single third party were not. Thus, in the context of our experiment, more than one third party is needed to enforce the norm. However, this condition is probably met frequently in real life. Therefore, taken together, our results suggest that altruistic third-party sanctions are likely to be powerful enforcers of social norms" (p. 85). In a work group, particularly, a shirker might face only slight retaliation from any one of his coworkers, but the total impact of retaliation from a large number of coworkers (being "put in Coventry") could reduce the overall payoff to the shirker.

Fehr and Fischbacher also observe, as has been observed in other experimental studies limited to second-party reciprocity, that agents who themselves act noncooperatively are much less likely to retaliate than those who act cooperatively. This is not surprising, since third-party retaliation, in particular, is an altruistic act. However, it is also possible that different agents frame the actions of others differently. Those who act noncooperatively may not frame noncooperative actions of others as unfavorable or aggressive, while those who act cooperatively do. The experimental evidence suggests that people are more likely to retaliate against those who act *more selfishly* than they themselves do, rather than against those who act *selfishly* in abstract.

## 6. MODELING THIRD-PARTY RECIPROCITY IN WORK GROUPS

In the context of a work group, we begin by adding a "monitoring" activity, including both the observation of others and contribution to (either second or third-party) reciprocal punishment of shirkers. Let  $m_i$  be the quantity of

monitoring activity undertaken by worker  $i$ . This activity is a contribution to an overall “fund” of mutual monitoring activity that can be measured by the average of  $m_i$  over all  $i$ . Let

$$m = \frac{1}{N} \left( \sum_{i=1}^N m_i \right) \quad (8a)$$

the average rate of monitoring activity. We suppose that there is a recognized social norm for effort,  $e^*$ . For the purposes of this study  $e^*$  is assumed to be the efficient (cooperative) average effort level. A particular shirker will experience more punishment both as  $m$  is greater and as her own effort falls short of the social norm. As a first approximation let the degree of punishment of agent A be  $m(e^* - e_i)$  if  $e_i < e^*$ . Similarly we suppose that agents will be more motivated to commit themselves to monitoring activity as the average effort falls below the norm, i.e., we could measure the motivation to monitor by  $(e^* - e)$  if  $e < e^*$ .

To make the analysis comparable with the maximization models that have been used to characterize the cooperative and noncooperative solutions to the effort game, we suppose that agents act as if they maximize an extended evaluation function  $E(\cdot) = U + V$ , where  $U$  measures the self-interested motivation (so that  $U$  is utility) and  $V$  measures the non-self-interested motivation on the same scale (Levine, 1998, e.g.). Note that  $E_i$  should not be confused with the utility function. To confute them is to confuse means with ends. The motives measured by  $V$  are emotions, but they are emotions conditional on a failure to realize a social norm, and are a means, while the realization of the social norm is the end. Suppose, for example, we apply this approach to public policy selection. It may well be that the policy that maximizes  $E$  is one that encourages shirking or other violations of social norms, increasing  $V$  but depressing  $U$ . Surely this would be a misunderstanding and the better policy would be one that discourages shirking, increasing  $U$ ; but at the same time a policy that takes into account the tendency of individuals to respond to the emotions expressed as  $V$ .

We suppose agent  $i$  commits resources  $m_i$  to the mutual monitoring activity. Then his evaluation function is incremented (relative to his self-interested utility) by the increment function

$$\Delta_i = \left\{ \begin{array}{ll} m_i(e^* - e) & \text{if } e < e^* \\ 0 & \text{if } e \geq e^* \end{array} \right\} \quad (8b)$$

Thus, a course of action is more highly evaluated if the rate of monitoring activity is higher, and the evaluation rises with monitoring activity in

proportion as average effort falls short of the social norm. The increment function  $\Delta$  is a NET addition to self-interested utility as a result of monitoring, after deducting the (subjective, self-interested) cost of the monitoring activity from the (subjective but non-self-interested) positive motivation for reciprocal action. This activity of monitoring goes into a fund, as it were, that increases the rate at which defectors from the social norm are punished. The higher is this average rate, the more thoroughly a defector is “punished” by a decrement of his (subjective, self-interested) utility. The decrement function is

$$\nabla_i = \begin{cases} m(e^* - e_i) & \text{if } e_i < e^* \\ 0 & \text{if } e_i \geq e^* \end{cases} \quad (8c)$$

The decrement increases with the shortfall at a rate equal to the average rate of monitoring activity. Thus, the evaluation function is

$$E_i = g_i(h, w, e_i) + \Delta_i - \nabla_i = g_i(h, w, e_i) + m_i(e^* - e) - m(e^* - e_i) \quad (8d)$$

The second equality refers to the case of particular interest, in which  $e < e^*$ ,  $e_i < e^*$ .

## 7. MUTUAL MONITORING AND EFFICIENT EFFORT

We now modify the model of Section 4 to allow for non-self-interested motivations on the part of the employees that are consistent with experimental evidence on reciprocity motives and “third-party punishment” along the lines of Fehr and Fischbacher. The model will be a maximization model with an objective function as sketched in the previous section.

Each agent  $i$  maximizes Eq. (8d) treating  $h$  as given and subject to constraints 1, 2, 4, and

$$m \geq 0 \quad (9a)$$

$$m \leq \frac{1}{N} \sum_{j=1}^N m_j \quad (9b)$$

$$m \geq \frac{1}{N} \sum_{\substack{j=1 \\ j \neq i}}^N m_j = M^* \quad (9c)$$

The Lagrangean function and necessary conditions are shown in [Table 5](#).

**Table 5.** Necessary Conditions with Mutual Monitoring.

---

T.5.1.	$L^\bullet = E_i + \mu_i \left[ pf(Nh, e) - F \right] \frac{1}{N} - w \Big] + v_i \left[ \frac{1}{N} \sum_{j=1}^N e_j - e \right] + \phi_i \left[ \frac{1}{N} \sum_{j=1}^N m_j - m \right] + \psi_i [m - M^*]$
T.5.2.	$\frac{\partial L^\bullet_i}{\partial w} = \frac{\partial g_i}{\partial w} + \mu \leq 0$
T.5.3.	$\frac{\partial L^\bullet_i}{\partial e_i} = \frac{\partial g_i}{\partial e_i} + m + \frac{v}{N} \leq 0$
T.5.4.	$\frac{\partial L^\bullet_i}{\partial e} = -m_i + \mu p \frac{\partial f}{\partial e} \frac{1}{N} - v \leq 0$
T.5.5.	$\frac{\partial L^\bullet_i}{\partial m_i} = e^* - e + \frac{\phi_i}{N} \leq 0$
T.5.6.	$\frac{\partial L^\bullet_i}{\partial m} = -(e^* - e_j) - \phi_i + \phi_i \leq 0$

---

First, suppose that we have an interior solution and in particular  $m_i > 0$ . It follows that  $\varphi_i = 0$  and T.5.5 and T.5.6 are equalities (If agent  $i$  monitors then Eq. (9c) is a strict inequality).

$$e_i = e^* + N(e - e^*) \tag{10a}$$

Averaging over  $i$ , this is

$$e = (1 - N)e^* + Ne \tag{10b}$$

That is,

$$(1 - N)e = (1 - N)e^* \tag{10c}$$

i.e.,

$$e = e^* \tag{10d}$$

i.e., the cooperative average effort level must be realized. Note that this is true when there is an interior solution in  $m_i$  for any  $i$ .<sup>3</sup>

Now suppose there is a corner solution for  $i$  in that  $m_i = 0$ . A similar averaging procedure will establish that  $e < e^*$ . Again, this follows if, for any  $i$ ,  $m_i = 0$ . Since either  $e = e^*$  or  $e < e^*$  but not both, we may infer that, in equilibrium, either all or no members engage in monitoring, and if they do engage in monitoring then the cooperative outcome will be realized.

The necessary conditions can also be used to determine the value of  $m_i$  and  $m$  in the two cases. From T.5.3 and T.5.4,

$$m_i = Nm + N \frac{\partial g}{\partial e_i} + \frac{\partial g_i}{\partial w} p \frac{\partial f}{\partial e} \frac{1}{N} \tag{11a}$$

Recall that (in the case of identical workers and an utilitarian and egalitarian decision process in the cooperative) the condition for the cooperative solution is

$$\frac{\partial g}{\partial w} p \frac{\partial f}{\partial e} = -N \frac{\partial g}{\partial e_i} \tag{11b}$$

Substituting in Eq. (11a),

$$m_i = Nm + (N - 1) \frac{\partial g}{\partial e_i} \tag{11c}$$

Once again, averaging over  $N$  workers, and continuing to assume that all workers have identical preferences, we obtain

$$m_i = - \frac{\partial g}{\partial e_i} \tag{11d}$$



Of course, this simple result – that the rate of monitoring activity is identical with the marginal disutility of effort – reflects the many simplifying assumptions we have made, but the more general implication would be that agents would monitor one another more intensely when their own experience of effort is more aversive.

Now suppose we have a corner solution with  $m_i = 0$ . Then Eq. (11a) yields

$$m = -\frac{\partial g}{\partial e_i} - \frac{\partial g_i}{\partial w} p \frac{\partial f}{\partial e} \frac{1}{N^2} \quad (11e)$$

If all workers are identical then all have  $m_i = 0$  and therefore  $m$  is zero. Therefore,

$$\frac{\partial g_i}{\partial w} p \frac{\partial f}{\partial e} \frac{1}{N^2} = -\frac{\partial g}{\partial e_i} \quad (11f)$$

which is, again, the condition for the noncooperative equilibrium.

The conclusion is that, with mutual monitoring based on reciprocity motives, there are two possible equilibria, and they correspond to the cooperative and noncooperative solutions of the original social dilemma of effort provision. Moreover, if the workers' tastes are not very different, the cooperative equilibrium corresponds to the utilitarian and egalitarian cooperative equilibrium and is Pareto-preferable to the noncooperative equilibrium. Pareto ranking provides the basis for "refinement" of the equilibrium by eliminating the Pareto-inferior equilibrium. Thus, on a pure rational-action theory, the predictions of the theory are that mutual monitoring will occur at a positive rate and that the effort provided will approximate the cooperative solution. There is, however, another possibility. As Schelling (1960) observed, in a game with two or more equilibria, the expectations of the agents may determine which equilibrium is realized. In this case, if the members expect high levels of mutual monitoring and productivity, their interdependent decisions will lead to a Nash equilibrium characterized by these things; whereas, if they expect low levels of monitoring and productivity, their interdependent decisions will lead to a Nash equilibrium that realize the low expectations. Thus, the duality of equilibrium in this case could point up the importance of the standard that cooperatives should be voluntary organizations. Those who enter a cooperative voluntarily are likely to be selected for positive expectations, while those forced by the state to enter a "cooperative" are not and may have experiences that reasonably lead them to negative expectations.

In summary, in this extended model, we find that there are two equilibria, and they correspond to the cooperative and noncooperative solutions of the original game. Since the cooperative solution is Pareto-preferable to the noncooperative solution, the cooperative solution is the predicted outcome, which appears consistent with the empirical studies; although the prediction could be sensitive to expectations and to the voluntary character of the cooperative.

## 8. SUMMARY AND CONCLUSION

A worker cooperative is an association of labor suppliers that operates according to cooperative principles, so that the employee-members are themselves the ultimate supervisory authority. This leads some critics to suppose that the members will shirk and that supervision will be ineffective and labor productivity will suffer as a result. Observations suggest the contrary, that workers in a cooperative will informally monitor one another and achieve higher productivity than conventional firms. This paper formalizes the determination of effort in a work group as a social dilemma, with an efficient cooperative solution but a lower-productivity noncooperative solution. However, the simple contrast of noncooperative and cooperative solutions of this game (and identification of cooperative enterprises with noncooperative solutions) ignores a large and growing body of evidence of reciprocity as a universal human motivation. The formal model is extended by adding a mutual-monitoring activity and reciprocity motivations for engaging in “third-party punishment” along lines suggested by some recent experimental studies. This extended model has two Nash equilibria – one each corresponding to the cooperative and the noncooperative solutions of the original game. What this suggests is that the cooperative solution is viable in a work group in which the workers frame effort as a reciprocal gift, and if they do frame effort in this way in worker cooperatives, this could explain the observed tendency of cooperatives to attain higher productivity.

## NOTES

1. This definition is broader than “workers’ cooperative,” including as well consumers’ cooperatives, farmer and public utility cooperatives, and mutual financial organizations, among others.

2. From the definition of a Pareto optimum, we might maximize the utility of agent  $j$  subject to  $N-1$  constraints that the other agents not be reduced below given utility levels. In that case  $\lambda_j$  is 1 and the others are Lagrangean multipliers for the  $N-1$  constraints. That maximum problem is formally identical to this one.

3. If we assume that individual *utility* also depends on the individual's contribution to the monitoring fund, the case is a little more complex. For example, if monitoring activity is intrinsically unpleasant, so that  $u_i$  decreases with increasing  $m_i$ , then the members will limit their monitoring activity below the efficient level. On the other hand, if monitoring is pleasurable, then the members will overmonitor and effort will be excessive! The pure case considered here is thus something of an ideal case. It highlights the duality of the equilibria for this model, with one equilibrium corresponding to the cooperative and one to the noncooperative solution of the underlying game, and illustrates how reciprocity can enhance the productivity of some real-world cooperatives, although perhaps not of all.

## REFERENCES

- Bartlett, W., Cable, J., Estrin, S., Jones, D., & Smith, S. C. (1992). Labor-managed cooperatives and private firms in North Central Italy: An empirical comparison. *Industrial and Labor Relations Review*, 46(1), 103–118.
- Bellas, C. (1972). *Industrial democracy and the worker-owned firm: A study of twenty-one plywood companies in the Pacific Northwest*. New York: Praeger.
- Berman, K. V. (1967). *Worker-owned plywood companies*. Pullman, Washington: Washington State University.
- Bernstein, P. (1976). *Workplace democratization: Its internal dynamics*. Kent, Ohio: Kent State University Press.
- Bonin, J. P., Jones, D. C., & Putterman, L. (1993). Theoretical and empirical studies of producer cooperatives—will ever the Twain Meet? *Journal of Economic Literature*, 31(3), 1290–1320.
- Cable, J., & Fitzroy, F. (1980). Productivity, efficiency, incentives and employee participation. *Kyklos*, 33, 100–121.
- Carson, R. (1977). A theory of cooperatives. *Canadian Journal of Economics*, 20(4), 565–589.
- Craig, B., & Pencavel, J. (1993). The objective of worker cooperatives. *Journal of Comparative Economics*, 17, 288–308.
- Doucouliaagos, C. (1995). Worker participation and productivity in labor-managed and participatory capitalist firms: A meta-analysis. *Industrial and Labor Relations Review*, 49(1), 58–77.
- Fehr, E., & Fischbacher, U. (2004). Third-party punishment and social norms. *Evolution and Human Behavior*, 25, 63–87.
- Furubotn, E. (1976). The long-run analysis of the labor-managed firm: An alternative interpretation. *American Economic Review*, 66(1), 104–124.
- Furubotn, E. (1980). The socialist labor-managed firm and bank-finance investment: Some theoretical issues. *Journal of Comparative Economics*, 4(2), 184–191.
- Furubotn, E., & Pejovich, S. (1970). Property rights and the behavior of the firm in a socialist state: The example of Yugoslavia. *Zeitschrift für Nationalökonomie*, 30(3), 431–454.

- International Cooperative Alliance (1995). Statement on the co-operative identity. <http://www.ica.coop/ica/info/enprinciples.html>, February 21, 2005.
- Jensen, M., & Meckling, W. (1979). Rights and production functions: An application to labor-managed firms and codetermination. *Journal of Business*, 52(4), 469–506.
- Levine, D. (1998). Modeling altruism and spitefulness in experiments. *Review of Economic Dynamics*, 1(3), 593–622.
- McCabe, K., Rassenti, S., & Smith, V. (1996). Game theory and reciprocity in some extensive form games. *Proceedings of the National Academy of Science*, 13421–13428.
- McCain, R. A. (1980). A theory of codetermination. *Zeitschrift fur Nationalokonomie*, 40(12), 65–90.
- McCain, R. A. (2004a). *Game theory: A nontechnical introduction to the analysis of strategy*. Mason, Ohio: Thomson South-Western.
- McCain, R. A. (2004b). Semi-effective games. Presented at the Second World Congress of the Game Theory Society, Marseille, July 5–9.
- McCain, R. A. (2006a). Worker-cooperatives and participatory enterprises. International encyclopedia of public policy: Governance in a global age. Routledge, London.
- McCain, R. A. (2006b). Worker cooperatives, effort and shirking: A semi-effective game model. *Proceedings, sixth meeting on game theory and practice dedicated to development, natural resources, and the environment*, Zaragoza, Spain, July.
- Schelling, T. (1960). *The strategy of conflict*. Cambridge: Harvard University Press.

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# R&D, INNOVATION AND NETWORKING: STRATEGIES FOR COOPERATIVE SURVIVAL<sup>☆</sup>

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## ABSTRACT

*This paper examines R&D and innovation patterns of firms in a mixed industry as a possible explanation of relative scarcity of worker cooperatives in market economies. In a set of simulations of a dynamic evolving industry, cooperatives and investor-owned firms are contrasted with regard to their attitudes toward research and development in their controlling inputs, and the non-controlling inputs. We investigate the conditions under which networking according to the principle of cooperation among cooperatives helps cooperative firms maintain significant market share in the industry. It turns out that forming close networks is a good policy for cooperative survival, even when investor-owned firms have the innovation rate advantage.*

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## 1. INTRODUCTION

Economic literature has established some clear advantages of worker ownership and profit sharing, such as reduced costs of monitoring, increased levels of effort and productivity, job creation, social concerns of cooperatives, etc. (Vanek, 1970; Bonin, Jones, & Putterman, 1993; Ben-Ner, Montias, & Neuberger, 1993; Craig & Pencavel, 1993; Dow, 2003). In practice, however, worker cooperatives and labor owned and managed firms continue to be relatively few. A number of explanations of comparative disadvantages have been suggested, such as non-alienability of labor and labor immobility, under-capitalization due to the horizon problem, the problem of the commons and governance issues, and inherent instability of cooperatives that increasingly hire non-member employees, among others (see Dow, 2003, for a critical assessment of the literature). Explanations for a relatively small number of worker cooperatives can be found either in theories of their relative inefficiency and their exit, such as degeneration and organizational instability (see Ben-Ner, 1984, for example), or account of barriers to entry (Ben-Ner, 1988; Stewart, 1991; Pérotin, 2004a; Pérotin, 2004b). There are some important cases of viable cooperative and labor-managed systems<sup>1</sup> that involve either networks of cooperatives and labor-owned structures (Mondragon in the Basque region of Spain, La Lega Cooperativa in the Italian North), or labor intensive industries. Employee-owned firms that may be both large and capital intensive, emerge primarily through employee buyouts, or Employee Stock Ownership Plans (Blasi & Kruse, 1991).

In this paper we broaden the discussion about relative scarcity of labor-owned cooperatives by setting up a model of the evolution of a mixed industry, including firms' investment in research and development. We consider different technologies and divergence in the dynamic adjustment of the two types of firms, to address two issues: we question if plausible differences in R&D strategies of cooperatives compared to investor-owned firms may produce an additional explanation for their limited presence in market economies, and if so, we examine whether structured creation of cooperative networks may be a good strategy for cooperative survival in mixed industries. At the present time, we do not include any of the specific characteristics of cooperative firms (CFs), compared to their profit-maximizing counterparts, such as ratio of member versus non-member employees, or alternative goals of the firm. Our aim is to isolate the effect of R&D investment strategies that have been overlooked in the labor-management literature, with the exception of the implicit impact of under-capitalization

and small size of CFs on their ability to invest in R&D, and to discuss the possible influence of these strategies on the presence of worker cooperatives in market economies.

Our point of departure is the original Nelson and Winter (Nelson & Winter, 1982) model of an evolving economy, where firms are involved in Schumpeterian evolution through innovation and competition. While the NW stream of literature deals exclusively with the capital input and capital-owned firms, the main focus of this paper is the comparison of CF and investor-owned and managed firm (IOF) in a NW economy, in order to account for some differences between the two types of firms that may, at least in part, explain the incidence and market share patterns of the two types of firms.

In a highly stylized model, using computer simulations, we examine the dynamics of a mixed industry, measuring the rate of survival of cooperative firms compared to the investor-owned group. We think of CFs as firms that will more likely invest in labor-oriented technology<sup>2</sup> or in organizational and social innovations that increase labor productivity, while IOFs as firms concentrated on technical innovations, with focus on capital input. Different types of technologies, and different innovation strategies are likely, since firms' owners supply different inputs, and have diverse objectives. This difference motivated us to model these firms in two separate groups that can then interact through the market mechanism. The separation also allows us to model interaction within a group of firms of equal type, and across types.

In the NW tradition, generally speaking, firms can either be innovators, or they can imitate technology of other firms. We continue with that tradition in our model, but we also explore a mixed economy in which both types of firms compete in the market, and are the more likely innovators in their controlling<sup>3</sup> input, while they are imitators in non-controlling input technology. We otherwise treat the two groups of firms in the same way, expanding on the notion raised by Craig and Pencavel (1993) that there are "...durable benefits to each type of organization, but that one is not superior to the other in overall efficiency" (p. 291).

In the remainder of the paper we sketch the characteristics of a standard Nelson and Winter evolutionary industry, and describe the model used in simulations. The process of innovation and imitation of technology is described, and cross-imitation between the two types of firms is defined. Comparison of R&D behavior of the two types of firms is examined in Section 3, part of which is dedicated to exploration of networking as a strategy for cooperative survival. Section 4 concludes.



## 2. THE MODEL

### 2.1. Characteristics of Firms in an Evolving Industry

As stated in the introduction, our point of departure is the original Nelson–Winter type of an evolving economy (Nelson & Winter, 1982, chapter 12), enhanced by consideration of the learning firms (Yildizoglu, 2002). In a standard NW model,<sup>4</sup> firms employ capital and other inputs using the Leontieff fixed proportions technology. Firms are constrained by the capital they use, while other inputs are hired on the market at a prevailing price. A part of firm’s earnings is spent on innovation, but they may also spend resources imitating the technology of other firms in the industry. While a typical NW firm uses fixed rules for innovation and imitation, Yildizoglu (2002) expands the model to include the learning firms – firms do not resort to fixed proportion of profits for technology improvements, but they evolve over time, learn from the past decisions, and adapt their rules accordingly. We adopt the latter approach and use genetic algorithm<sup>5</sup> (GA) learning to describe firm’s adaptation of new technology. While more sophisticated learning techniques can be applied, we use Yildizoglu’s formulation as a benchmark, given his application to a Nelson and Winter type of industry that we use here as well.

As in the standard NW model, our firms are constrained by capital, and are able to hire all the labor and other inputs necessary to produce the output with the given level of capital, if they are investor-owned (IOF). The costs of all inputs are therefore fixed per unit of capital used in production (Nelson & Winter, 1982; Yildizoglu, 2002; Andersen, 1998, 2001). A CF in our model is symmetrical – it is labor-constrained, it can hire all the capital and other inputs it needs, and it is concerned with labor input only.

We assume that the two types of firms have different approaches to innovation-investor owners in IOF are interested in capital technology, while labor-owners in CF are more interested in innovations focused on human resources, social innovations, and labor enhancing techniques. Both types of firms will increase productivity of their controlling input as a result of their innovations.

The model is set up as follows: A firm  $j$  produces a homogeneous product according to the Leontieff production function:

$$Q_j = \min(A^K K, A^L L) \quad (1)$$

Where  $A^K$  and  $A^L$  represent productivity of capital and labor inputs, respectively.

If the firm is investor-owned (IOF), it hires all the labor necessary to employ a given level of capital,  $K$ , while a CF hires required capital, given the labor input,  $L$ . Their production functions, therefore, become:

$$Q_j = A_{jt}^K K_{jt} \quad \text{if IOF} \quad (2)$$

and

$$Q_i = A_{it}^L L_{it} \quad \text{if CF} \quad (3)$$

The demand function is of the form

$$P = \frac{D}{Q^{1/\eta}} \quad (4)$$

Where  $Q = \Sigma Q_j + \Sigma Q_i$ ,  $\eta$  is the Marshallian elasticity and  $D$  is exogenous demand, equal to income when  $\eta = 1$ .

Firms hire all necessary inputs at given market prices. Their costs per unit of capital (labor) are constant, and equal  $c_K$  ( $c_L$ ) for IOF (CF) respectively.

Each IOF calculates its profit according to the following equation:

$$\pi_{jt} = PQ_{jt} - c_K K_{jt} = PA_{jt}^K K_{jt} - c_K K_{jt} \quad (5)$$

and each CF according to:

$$\pi_{it} = PQ_{it} - c_L L_{it} = PA_{it}^L L_{it} - c_L L_{it} \quad (6)$$

Firms are engaged in research and development; they spend funds on innovations and improvements of technology they use in production throughout their life. We assume that rules applied to R&D change and evolve according to the changes in the firm's environment, and history of its past decisions. As stated above, we consider the "learning firms," rather than firms with a predetermined R&D investment rule. Therefore, firms decide how much to invest by a GA, where a set of rules are evaluated and the best one at a given time,  $t = 0$ , is adopted. The rule is used for a number of periods,  $r$ ; new rules are evaluated at time  $t + r$ , the best one is adopted, and the process is repeated in intervals of  $r$  periods. This reflects the fact that firms try a strategy for a while before they look for a new one (Yildizoglu, 2002). Each firm in our simulated industry deals with a set of 30 rules that cross and mutate to create the most profitable individuals. Once the rule is adopted, it defines a fraction of profit committed to R&D, as long as profit is non-negative.

Profit in generation  $(t + 1)$  is determined as follows:

$$\pi_{jt+1} = pQ_j - c_K K_{jt} - rd_j \pi_{jt} \quad (7)$$

$$\pi_{it+1} = pQ_i - c_L L_{it} - rd_i \pi_{it} \quad (8)$$

where  $rd_{j,i}$  represents the fraction of profit in period  $t$  invested in research and development by firm  $j,i$ .

## 2.2. Technical Progress

Once they commit their resources, firms can choose to either innovate, or spend their funds on imitation of the leading technology or practices in the industry. Each strategy has its advantages and disadvantages, but NW models typically result in high industry concentration, since more profits mean more investment and therefore the dominant firm rapidly grows to monopolize the industry (NW, chapter 13; also see Andersen, 1998, 2001). Imitation slows that process down, especially if other firms' technology is easily accessible. Still, the formulation of random increases in productivity and adaptation process where the survival of the fittest is the driving force of selection will result in industry concentration (Fagerberg, 2003, p. 147). While we do add some variety through relatively high mutation, concentration is not our concern. We place the emphasis of simulations on the relative market share of the two types of firms. The fact that one firm may dominate the industry due to the selection process is not our focus, rather *what type* of firm is taking over is what we want to address. In particular, entry is excluded, thereby neglecting an important source of variation and competition, which would likely reduce concentration tendencies.

We consider two types of imitation: own-imitation, where firms copy technology from similar firms, and cross-imitation, where technology in the non-controlling inputs is emulated from other firms. In other words, firms can emulate technology from their own group of firms with some probability, but they may also copy from others, if that would give them the competitive edge. Emulating capital technologies by both types of firms is not new, while examples of emulation of social innovations are ever more present in fair trade supply chains, championed by cooperatives, for example.

### 2.2.1. Innovation

Firms' innovation patterns are subject to random events, but they are also a function of resources spent on research and development. Larger firms are

therefore at an advantage, since the more profitable they are, the more they will invest in R&D, and the more likely the “hits” will result in a technological advancement. Probability of innovation (research and development spending) depends on the firm’s profitability. A random number is drawn to determine if the firm will innovate (i.e. choose to spend resources on R&D). If it does, another draw defines a technology variable,  $A'_t$ . The firm employs the new technology only if it proves to be more efficient than the old one, i.e. it innovates:

$$A_{t+1} = \max(A_t, A'_t)$$

Firms invest the remainder of their profit to increase their stock of capital (labor) as follows:

$$K_{t+1} = (1 - \delta)K_t + (1 - rd_j)\pi_{jt} \quad (9)$$

$$L_{t+1} = (1 - \rho)L_t + (1 - rd_i)\pi_{it} \quad (10)$$

Where  $\delta$  is the capital depreciation rate,  $\rho$  is the rate of labor attrition, and  $rd_{j,i}$  represents the fraction of profits spent on research and development by each firm. We require some predetermined minimum rate of R&D,  $rd_{\min}$ . Each firm sets aside the greater of the two, to define  $rd_{j(i)t} = \max(rd_{j(i)t}, rd_{\min})$ . Once determined by the GA, R&D rate is tested for five generations.

### 2.2.2. Own Imitation

If the firm did not use its R&D funds to innovate, it enters the imitation draw. If the firm’s market share is below the industry average, its probability of imitation increases, since we adopt the assumption that small firms will more likely spend their research funds on imitation, rather than be able to compete with technological innovations of the industry leaders (Kwasnicki & Kwasnicka, 1992).

If the firm imitates, it employs new technology as follows:

$$A_{t+1} = \max(A_t, A_t^{\max})$$

Where  $A_t^{\max}$  is the most productive technology currently used among equal firms in the industry.

### 2.2.3. Cross Imitation

Since our aim is to examine the effect of imitation of different technologies between two types of firms on the industry dynamics, we introduce the possibility that firms emulate the other group’s technology. CFs have to compete with the technology and practices of the investor-owned firms, but

the other way around is also true: investor-owned firms adopt techniques and procedures to increase human capital and labor productivity, as well as spend resources on social innovations, as stated above. We can think of shop floor participation as inherent to cooperatives, for example, but investor-owned firms also adopt it as a way to increase overall productivity. Alternatively, we can interpret the two types of innovations as organizational and technical innovations (Van Someren, 1992), with each group of firms leading in one type of innovations, and emulating the other.

The Nelson–Winter model we use is a one input model, where constant relative productivity of the two inputs is implicit. To capture cross-imitation, we include a change in productivity on the one hand, and increased cost per unit of input due to implementation of the alternative technology, on the other.

The probability that a firm will imitate other types of technologies is related to the productivity differential between the two firm types. We compare the imitator firm’s productivity in its controlling input to the maximum productivity of the other group of firms. In other words, the IOF will imitate the labor technology of the leading CF, or the CF will imitate the capital technology of the leading IOF. There must be a productivity differential between the two sectors at a given point in time for the firms to cross-imitate. Even with the differential, not all firms will imitate, or be profitable if they do. Firms enter a random draw to determine if they will cross-imitate. They can emulate the other type only if the other sector is more productive than their own, but this also increases per unit cost of the emulator. We assume that the copying firm’s costs increase in proportion to the productivity differential.

The cross-imitation process for the IOF can be described as follows: In a random draw the firm decides whether to imitate CF’s technology. The probability of cross-imitation is positively related to the profits of the firm relative to the industry average. If the firm decides to imitate, its productivity must be smaller than  $A_{\max}^L$  for imitation to proceed. Firm’s per unit costs of capital increase by a factor proportional to  $A_{\max}^L/A^K > 1$ , and it makes productivity gains equal to  $A_{\max}^L$ . We then check that profit is non-negative, and adopt the new technology. If the profit is negative, the firm continues to operate with its old technology, lagging behind other firms in the industry.

### 3. SIMULATIONS

#### 3.1. *A One Sector Industry*

We start building some points of reference by looking at the outcomes of simulations when all firms are of equal type. Parameters of the benchmark

model are listed in the appendix. In the first set of simulations, we explore the impact on price, productivity, and industry concentration, to establish some trends of the Nelson–Winter type of evolutionary models.

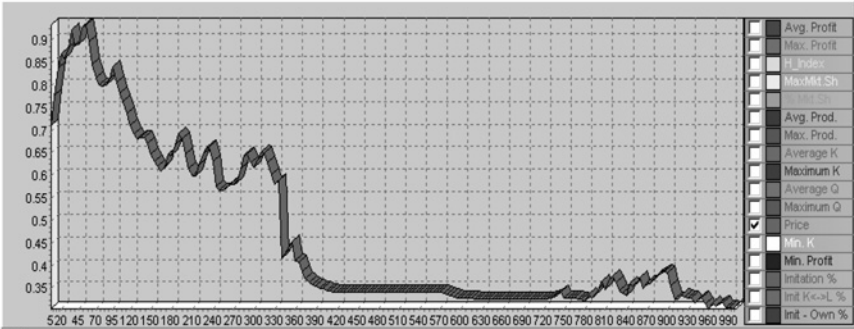
The results of a typical simulation run over 1,000 generations are illustrated in Fig. 1, with panels (a) through (c) showing the change in price, productivity and the normalized Herfindahl index,<sup>6</sup> respectively. A summary of the stylized facts of a NW model would include high concentration that becomes apparent fairly quickly. As illustrated in panel (c) of Fig. 1, one firm emerges as the industry leader; it innovates more often than other firms, and reaps the benefits in terms of both the profit and the market share.

When own imitation is included, the industry dynamics are significantly altered. Different rates of imitation relative to innovation are applied, and effects on productivity and industry concentration are illustrated in Fig. 2. Contrasted with Fig. 1, panels (b) and (c), Fig. 2a illustrates the average and maximum productivity and Herfindahl index for the 20 firm industry when low rate of imitation relative to innovation is included; Fig. 2b shows the impact of imitation when it is equally as accessible as innovation; and Fig. 2c represents high imitation rates relative to innovations in the industry.

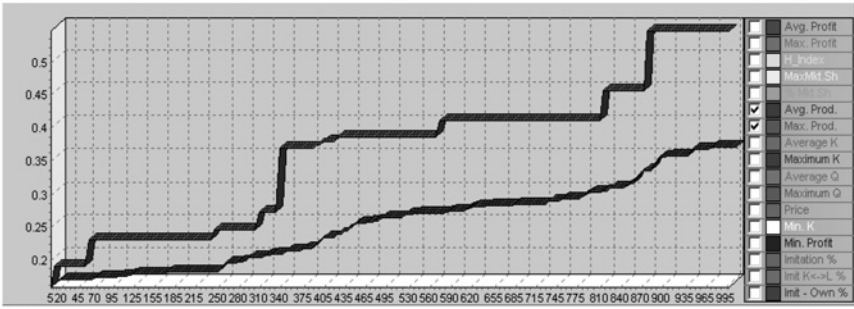
With imitation relatively easy (Fig. 2c), the process of concentration is slowed down considerably, but large firm dominance does not entirely disappear, since innovators have the advantage of high earnings early in the runs, and therefore, earn profits for a longer period of time than do the imitators. Imitating the leading firms pays off in terms of overall industry productivity, and welfare, reflected in larger output and decreased price. Imitation may be prohibitively costly, or technology difficult to emulate (firm-specific, product-specific, or proprietary innovation, for example), and that case is sketched in panel (a) of Fig. 2. Less prevalent imitation of technology slows down the overall productivity growth, in turn slowing down production, and reducing the price by a considerably smaller margin than possible when imitation is easy.

### 3.2. A Mixed Industry

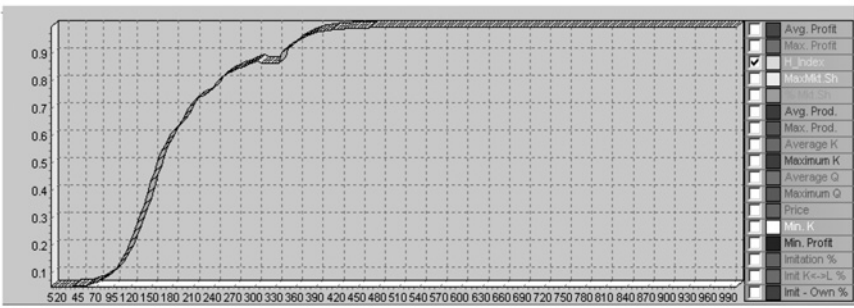
Next we look at the interaction of two groups – investor owned and CFs. An industry with 20 firms is considered, 10 of each type. It turns out that interaction between two types of firms produces concentration as well, but which type will dominate the industry is left to random events, as long as the two types of firms have identical probabilities of innovation, and imitation.



(a)

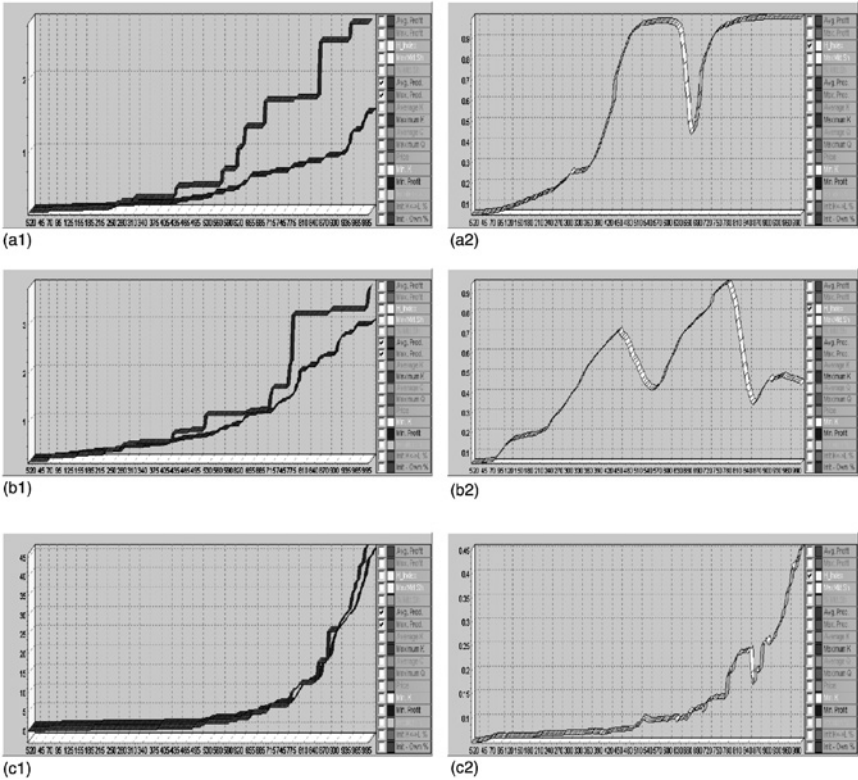


(b)



(c)

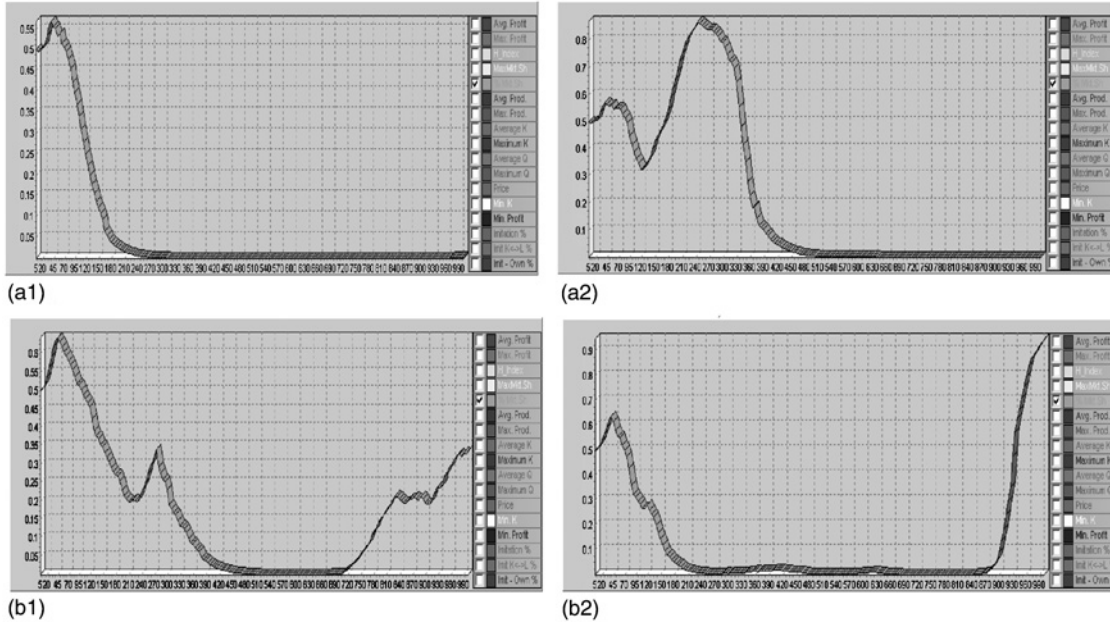
Fig. 1. Price Adjustment, Productivity and Industry Concentration with 20 Firms; Innovation Included. No Bankruptcy. (a) Price Change, (b) Average and Maximum Productivity, (c) Herfindahl Index (Normalized 0 to 1).



*Fig. 2.* Impact of Imitation on the Industry Productivity and Concentration; 20 Firms, 1,000 Generations; Firms of Equal Type. (a1) Average and Maximum Productivity; imit. Difficult, (a2) Herfindahl Index; Imitation is Difficult, (b1) Average and Maximum Productivity; Innovation and Imitation are Equally Accessible, (b2) Herfindahl Index, Innovation and Imitation are Equally Accessible, (c1) Average and Maximum Productivity; Imitation is Easy, (c2) Herfindahl Index; Imitation is Easy.

To illustrate this, we present two cases in Fig. 3, where each set of simulations is run with a different seed number, triggering a different sequence of random events, while all controlled variables are identical for the two types of firms. We want to illustrate the effect that access to innovation and imitation may have on the industry dynamics, and on the relative presence of the two groups of firms in the market. In Figs. 3 and 4 we portray market shares of the IOF type as a group – the market share of





*Fig. 3.* Market Share of IOF Group in the Industry with Two Random Sequences; with Innovation Only (Top 2 Graphs), and with Both R&D Strategies – Innovation and Imitation (Bottom 2 Graphs). (a1) IOF Market Share-Seed 187, no Imitation; inov. ratio<sup>9</sup> 0.95, (a2) IOF Market Share-Seed 187, Imitation Easy; inov. Ratio 0.86; imit Ratio 0.55, (b1) IOF Market Share-Seed 33, no Imitation, inov. ratio 0.91, (b2) IOF Market Share-Seed 33; Imitation Easy; inov Ratio 0.9, imit Ratio 0.84.

the CF group is easily deduced. One random sequence results in CF market dominance (Fig. 3(a1)), while in the other case, after the loss of market share entirely, IOF regains about 34% (Fig. 3(b1)). The two types of firms innovate at comparable rates in these two cases, and one can easily produce another set of simulations where the IOF would emerge as the dominant group with 100% market share, confirming the fact that there is no reason, other than chance, to expect one type to dominate over the other when they are equal in all respects.

If firms can imitate others in their group easily, CF dominance is preserved in our first case below (Fig. 3(a2)), while imitation in the second case of random events (Fig. 3(b2)) will produce IOF as the dominant type of organization in the last 100 generations, gaining about 95% of the market. To explore more closely what are the reasons behind market dominance of one group over the other, we look at the productivity comparison between the two, and the numbers of innovations of the IOF group over the CF group.

One may expect the innovation ratio for a group of firms that loses its market share to be under 1 for extended number of generations. While this is correct for most cases we examined, one has to keep in mind that the ratio of innovations is cumulative, and it only tells us that one group innovates less than the other over a period of time. Innovation ratio may therefore be below one, but the group may still preserve its market presence at the end of the run. Examining the productivity figures more closely, it becomes clear that productivity gains of the group result in gains of the market share, indicating that it is the scope of innovative activities, rather than the volume, that matters. Figure 4 illustrates this point.

Fig. 4 is the extension of case 3b2 above, where we can see that the IOF start to gain more market share approximately after generation 870, to supply 95% of the output by generation 1,000. Fig. 4 shows that after about generation 770, IOF (left graph) start to close in on the CF group, and surpass their productivity shortly thereafter, jumping from 15 to about 25 in 5–6 generations. It takes 160 more generations for CF group to reach that productivity level. Continuous gain in relative productivity ensures that IOF as a group start to dominate the market. Easy imitation of technology within the group allows high level of productivity for the whole group (average and maximum productivity are very close) and it results in relatively low concentration (Herfindahl index is approximately 0.15).

Innovative practices raise productivity, and it becomes clear that absolute numbers of hits, while making it more likely to succeed, are not enough for continued productivity gain. What matters is the magnitude of

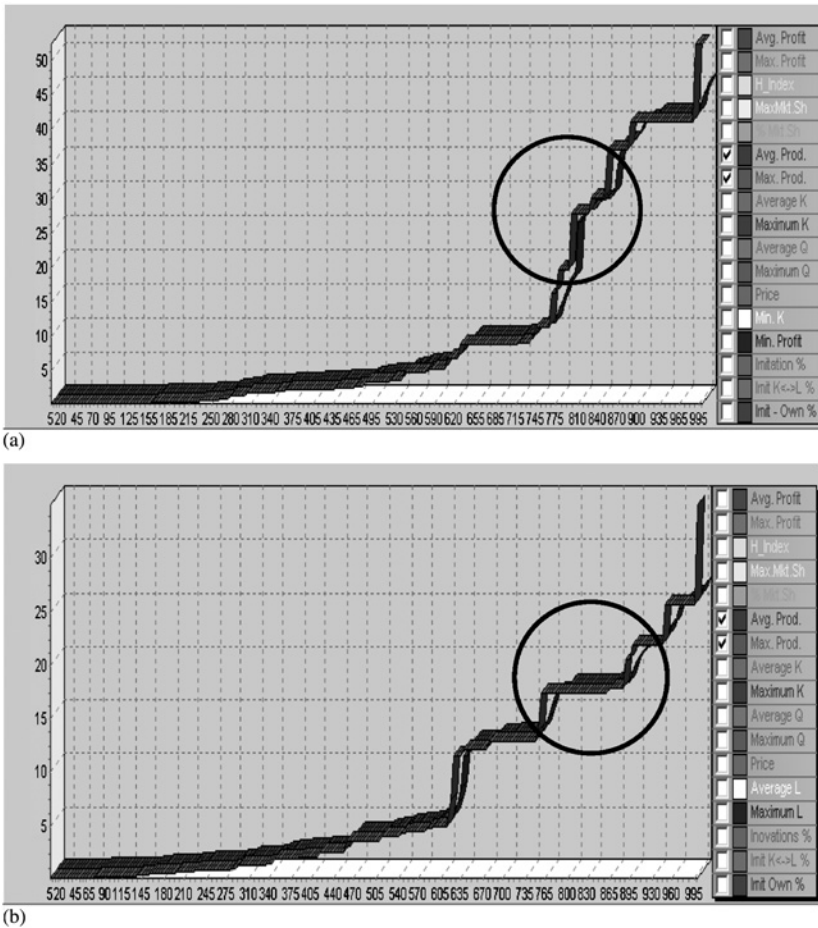


Fig. 4. Maximum and Average Productivity for the Two Types of Firms, Seed 33, with Imitation. IOF Left Graph, CF Right. Corresponds to the Case in Fig. 3(b2) above.

the impact of innovations on productivity. As long as the effect of innovation is greater in relative terms, the group makes considerable market advances. It is important to note that this effect is compounded by easy imitations. If imitation were not easy, it would be so much more difficult for a group of firms to recover from a loss of the market share. But, easy imitation also means that industry dominance of a group of firms,

measured by their market share, is very unstable, making it easier for either group to gain (or lose) its market presence. To illustrate this last point, we examine the effect of cross imitation between the two types of firms on market share and productivity.

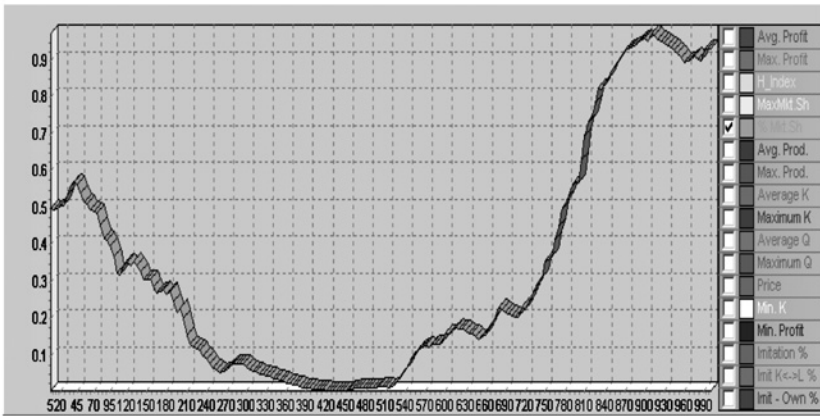
Figs. 5a and 5b can be compared to 3(a2) and 3(b2), respectively. In the above cases, as well as other cases we tested, cross imitation induced loss of the market presence of the dominant group if it consisted of firms with closely distributed market shares. In Fig. 3(a2) the IOF group lost its market share to the CF group, whose concentration ratio was low at 0.16, to regain it when cross imitation is included (Fig. 5a). This prompts us to formulate the following proposition:

**Proposition 1.** If concentration among the dominant group of firms is low, cross imitation is more likely to cause the loss of their market share.

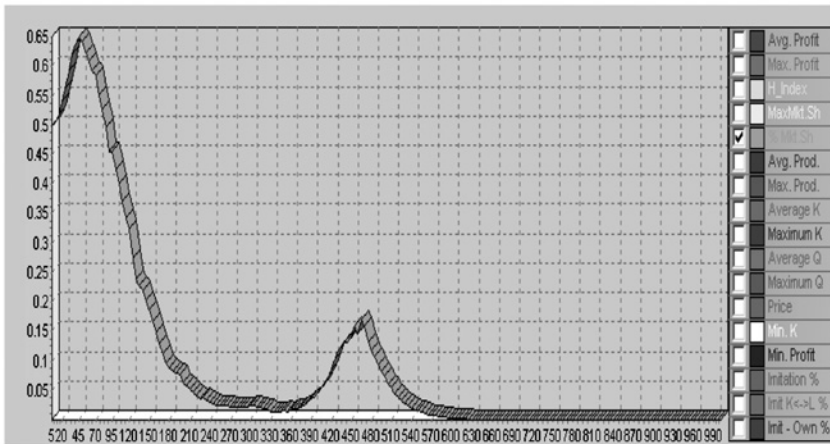
Proposition 1 implies that a dominant group of small firms, regardless of their type, can easily lose its dominance by emulating costly technology. Cross imitation could reduce profits of small firms to levels that may prohibit their further growth. The model captures a plausible explanation for small participation of CFs in market economies: they tend to be smaller firms, due to their governance structure, and purpose. Imitating capital technology may be too costly for the CF group, even though, taken in isolation, they may be a viable group of businesses. One has to keep in mind, however, that a lot of variation in the model is still due to random variables, and that the effect of entry is not captured in the simulations.

### 3.3. *Effects of networking*

Within the context of the model, we interpret own imitation as the effect of the creation of networks: the closer connected are the firms in a group, the easier it is to emulate each other's technology. Under this interpretation, it is of particular interest to examine the effect of diverse probabilities of innovation and imitation for the two types of firms, since cooperatives may be more likely to create networks if they employ the principle of cooperation among cooperatives,<sup>7</sup> while investor-owned firms may be less likely to do so. On the other hand, investor-owned firms might be more likely to invest in capital technology, given their easier access to capital (Dow, 2003; Bonin et al., 1993; Ben-Ner, 1988). The question we are particularly interested in is whether creation of networks is a good strategy for cooperative survival in mixed industries, assuming the innovation advantage of IOFs, and under



(a)



(b)

Fig. 5. Market Share of the IOF Over 1,000 Generations with 2 Different Seeds, Innovation, own Imitation and Cross Imitation are Included. (a) Market Share of IOF, Cross Imitation Included, Seed 187. IOF increases its market share, (b) Market Share of IOF, Cross Imitation Included, Seed 33. IOF Lost the Market Share it had Before Cross-imit.

what conditions. To answer this question, we run simulations of an industry assuming four different rates of innovation and imitation, from low ( $p_{in1}$  and  $p_{em1}$ ) to high ( $p_{in4}$  and  $p_{em4}$ ). Own imitation is interpreted to indicate the degree of interconnectedness of firms in a group. Since we discuss cases

when IOFs are more likely to innovate in capital technology, while CFs are more likely to create networks, we look at the following parameter combinations.

In all tested cases both types of firms apply both kinds of R&D strategies, but the likelihood of using one over the other differs for different types of firms. We examine the impact of increasingly more likely formation of networks for the cooperative group. Figs. 6–11 illustrate the cumulative market share for the CF group (top line, starting at 0.5) and H-index dynamics for the six cases listed in Table 1.

Figs. 6–8 above demonstrate that in industries with low rate of R&D the CFs may do well, even though they innovate at a much smaller rate, if their degree of networking is relatively high. CFs may make up in efficiency and productivity by employing the technology emulation strategy among equal firms, i.e. by creating cooperative networks and easy transfer of knowledge and technology within the group. On the other hand, in an industry with high R&D component, CFs are more likely to lose their market presence (see Figs. 9 and 10 above), unless they form very close networks (Fig. 11). The results of simulations support the claim that labor-owned firms, such as cooperatives, are more prevalent in low-innovation, labor intensive industries (Dow, 2003; Hansman, 1996). However, the case presented in Fig. 11 also illustrates that under certain conditions, and with high rate of innovation of both types of firms, relatively more innovative IOFs will lose the

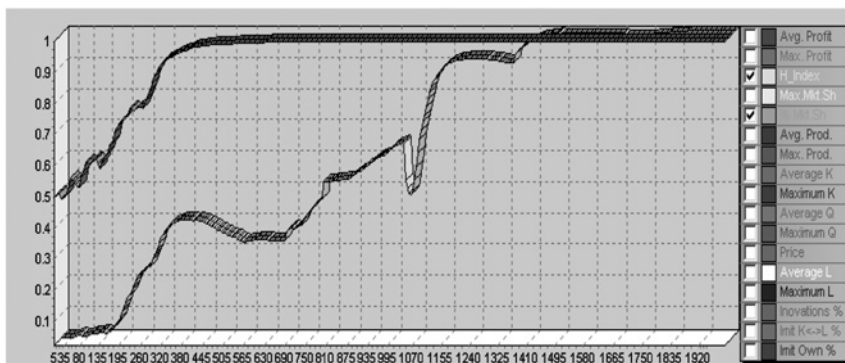


Fig. 6. Market Share and H-Index for CF. Probabilities:  $p_{in2}-p_{em1}$  (IOF) and  $p_{in1}-p_{em2}$  (CF). 3 IOF and 2 CF Exit. Case LR1: Industry with Low Rates of R&D. IOFs are Twice as Likely to Innovate as the CFs, and the Reverse is True for Imitation. CFs Dominate the Market.

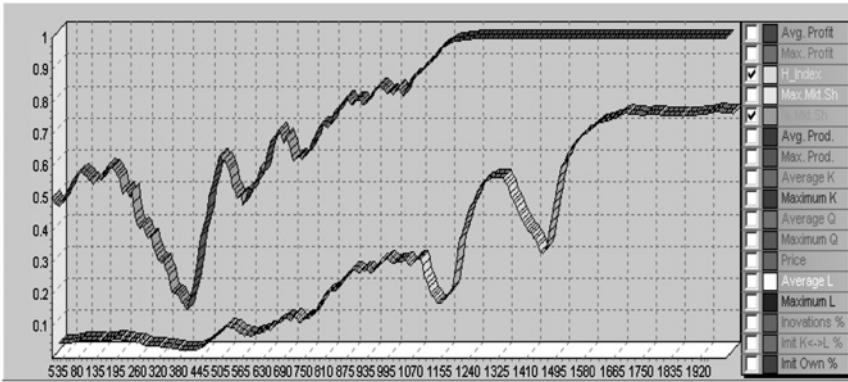


Fig. 7. Market Share and H-Index for CF. Probabilities:  $p_{in2}-p_{em1}$  (IOF) and  $p_{in1}-p_{em3}$  (CF). 3 IOF and 3 CF Exit. Case LR2: A Low-R&D Industry. IOFs are Twice as Likely to Innovate as the CFs, but CFs are Four Times as Likely to Create Networks Within their own group. H-Index is Lower with Higher Rate of Imitation.

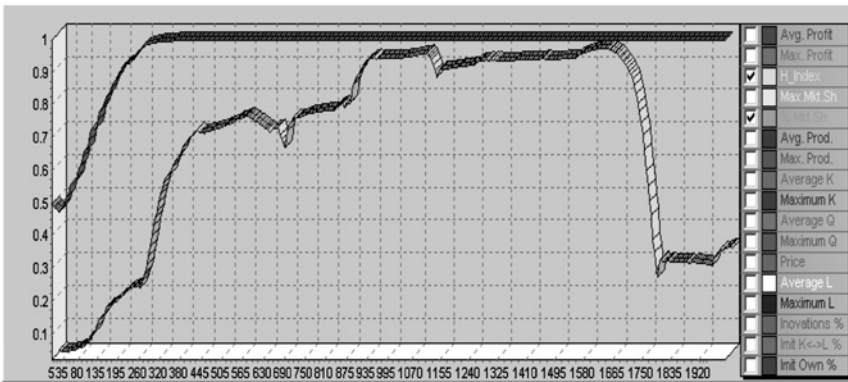


Fig. 8. Market Share and H-Index for CF. Probabilities:  $p_{in2}-p_{em1}$  (IOF) and  $p_{in1}-p_{em4}$  (CF). 4 IOF, and no CF Exit. Case LR3: A Low-R&D Industry. IOFs are Twice as Likely to Innovate as the CFs, While CFs Engage in Extensive Imitation. CF Dominance is Gained Relatively Quickly; Concentration Declines.

market share if CFs share their technology with other CFs. In other words, with an appropriate degree of innovative activity, even if below the level employed by the IOFs, cooperation among the cooperatives as a strategy may ensure the survival of CFs.

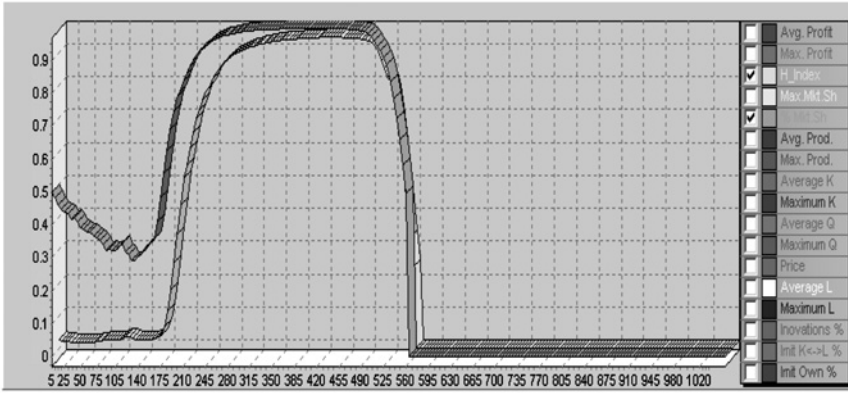


Fig. 9. Market Share and H-Index for CF. Probabilities:  $p_{in4}-p_{em1}$  (IOF) and  $p_{in3}-p_{em2}$  (CF). 1 IOF and all 10 CF Exit the Industry. Case HR1: Industry with a High Rate of R&D. CF Hold Their Market Presence for a While, but Eventually Lose out to the IOFs who Innovate More. Case HR1: Industry with a High Rate of R&D. CF Hold Their Market Presence for a While, but Eventually Lose out to the IOFs who Innovate More.

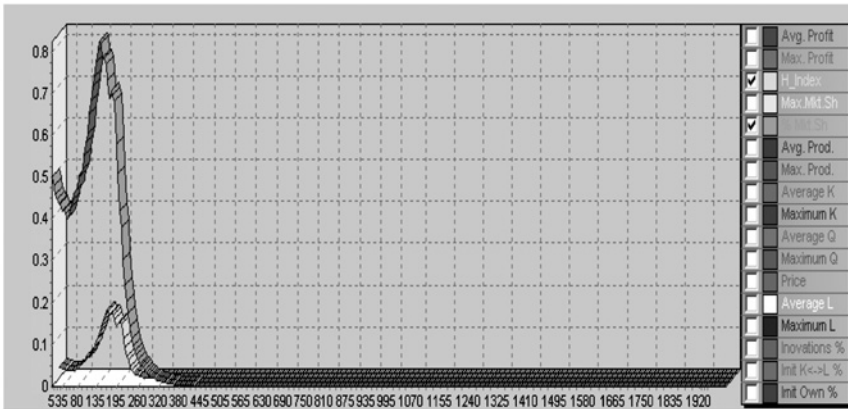


Fig. 10. Market Share and H-Index for CF. Probabilities:  $p_{in4}-p_{em1}$  (IOF) and  $p_{in3}-p_{em3}$  (CF). 2 IOF and 7 CF Exit. Case HR2: Industry with a High Rate of R&D. CFs Lose Their Market Presence Very Early on, Since IOF are Innovating at a Very High Rate. More Imitative Behavior Among CFs Does not Alter the Result, Since the IOF Group Advances with High Productivity.



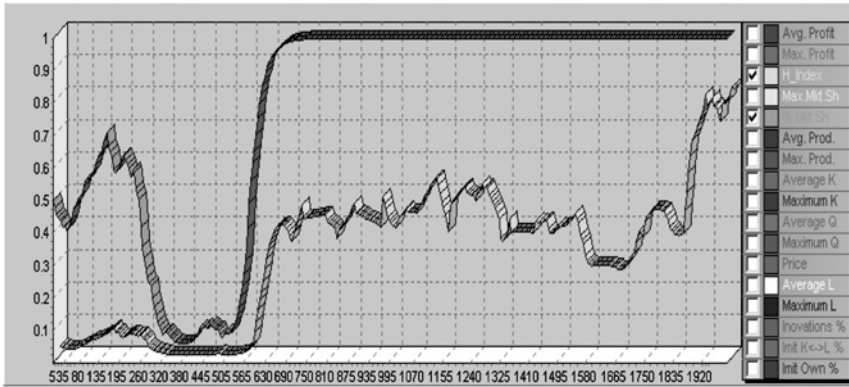


Fig. 11. Market Share and H-Index for CF. Probabilities:  $p_{in4}-p_{em1}$  (IOF) and  $p_{in3}-p_{em4}$  (CF). 7 IOF and no CF Exit. Case HR3: Industry with a High Rate of R&D. CFs Gain Their Market Share and Hold on to it Based on Very Easy Imitation, and Early Productivity Gains.

**Table 1.** Combinations of Probabilities of Innovation and Probabilities of Imitation for IOF and CF, in a Low-R&D Industry (LR Cases) and a High R&D Industry (HR Cases), Used in Simulations (Figs. 6–11).

Low-R&D Industry	IOF Probabilities of Innov. and Emul.	CF Probabilities of Innov. and Emul.	High-R&D Industry	IOF Probabilities of Innov. and Emul.	CF Probabilities of Innov. and Emul.
CaseLR1	$p_{in2}-p_{em1}$	$p_{in1}-p_{em2}$	CaseHR1	$p_{in4}-p_{em1}$	$p_{in3}-p_{em2}$
CaseLR2	$p_{in2}-p_{em1}$	$p_{in1}-p_{em3}$	CaseHR2	$p_{in4}-p_{em1}$	$p_{in3}-p_{em3}$
CaseLR3	$p_{in2}-p_{em1}$	$p_{in1}-p_{em4}$	CaseHR3	$p_{in4}-p_{em1}$	$p_{in3}-p_{em4}$

### 3.4. Simulations of a Mixed Industry with Other Varied Parameters

So far we have controlled for the differences between the two types of firms, beyond the interpretation of their technology variables, in order to isolate the impact of R&D strategies on the interaction between the two groups of firms. Our next step is to test the model under unequal conditions for the two types of firms, R&D variables being equal, and to then examine if a change in the degree of innovation or network creation would influence the results. Some of the possible differences between the two types of firms cited in the literature that can be tested by our model are discussed below.

Unequal access to inputs; if CFs face capital rationing, this would increase the cost of capital input per unit of labor used ( $c_L$  in Eq. (6) would increase) in our model.

Unequal rates of attrition; labor attrition may be lower than capital depreciation, particularly when labor immobility is high.

Profit constraint may be higher for IOFs; shareholders interest is represented by a higher return on their capital investment.

We generate each of these cases, to examine the effect of those differences on the market incidence of CFs. We start by testing the above cases without imitative research and development, and then look at the impact of emulation on the results. 20 firms, 10 of each type, with no imitation, represent our benchmark model. In it, CFs lose their market share by generation 250, but regain about 15% of the market by the end of 1,000 generations, mainly due to productivity gains of one firm.

Unequal access to non-controlling inputs – when cost per unit of labor is twice as high as the cost per unit of capital input, CFs lose the market share, as expected. Their output declines dramatically in the first 100 generations, and it remains negligible, with three out of ten firms bankrupt,<sup>8</sup> compared to the benchmark model where no bankruptcy occurred. IOF dominate the market, due to dominance of one firm with large capital stock, rather than significant productivity gains over the CF. When firms emulate technology within their group (i.e. the emulation operator is activated), CFs make sufficient productivity gains to offset the impact of high costs of capital per unit of labor, and they regain the market share. Their share oscillates around 80% from generation 600 to the end of the run. At the same time, Herfindahl index for CF is low, and, in accordance with Proposition 1, they lose their market presence once cross imitation is introduced. Intuitively, imitating capital technology proves to be too costly for the group of small CFs. Fig. 12 illustrates the own imitation case.

Another way to test the effect of under-capitalization in our model would be to keep the initial input level ( $L$ ) in the CF relatively small. We test this approach with stock of labor half the size of the IOF capital stock. Low- $L$ -case does not produce the same results, however. CF as a group may more readily gain the market share thanks to high productivity growth. This prompts the following propositions.

**Proposition 2.** The relatively small size of firms will not be the reason for their demise, if they innovate effectively in their controlling input technology.

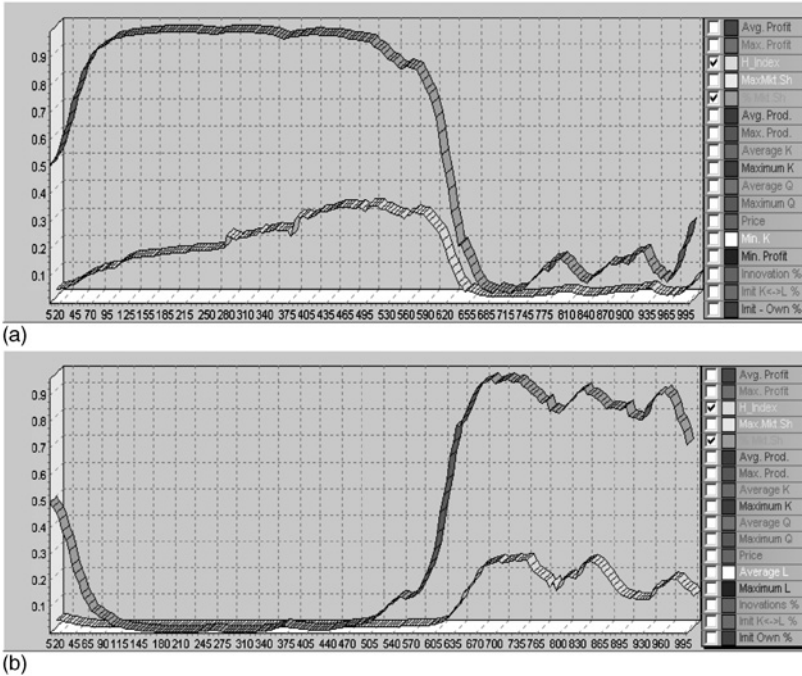


Fig. 12. Market Share and Herfindahl Index for IOF (Top) and CF (Bottom Graph) Group When Capital is Costly for CFs. Own Imitation is Included.

In other words, small firms will maintain their market presence if they keep their productivity high. But, if under-capitalization means that costs of capital are above the market level for CF, they will be more likely to dissolve. Note also that we start with equal number of firms in each group.

**Proposition 3.** If one type of firm is relatively under-represented in an industry, they either have to innovate at a relatively high rate to make productivity gains, or they must have cost advantages to survive.

Proposition 3 may have policy implications. If small firms produce positive externalities (social impact, for example), institutional support may be the appropriate method of ensuring their survival and provision of those externalities.

Labor attrition and capital depreciation – we test the model with increased rate of capital depreciation (5%). Everything else being equal, IOFs deplete their capital faster, and lose the market share. CFs dominate

early on, and imitation – either within the group of firms or between the groups – does not alter the market presence of IOFs. If firms innovate at a different rate, IOF being twice as likely to innovate as CF, IOF regain their market position even with high rate of capital depreciation. With our benchmark model settings, the IOF regain about 90% of the market by generation 700 when there is no imitation, and dominate the whole market by generation 300 if own-imitation is easy, where the effect of innovative efforts within the group are compounded. This exercise reinforces the importance of innovative activities for a group of firms to preserve market dominance, as illustrated in Figs. 13 and 14.

Higher profit constraint for a group of firms – IOFs may have a profit constraint that is more likely to be binding than do the CFs. We add reservation profit to the bankruptcy condition, and set IOF profit constraint to be twice as large as the CFs. Preliminary runs have indicated that firms within the group with higher profit constraint are more likely to exit the market, but the remaining firms in the group tend to grow faster, and may in fact dominate the market. Concentration within the group, under certain conditions, may be the result of higher profit margins. We tested the unequal profit constraint under the assumption that imitation is moderately easy within the firms in a group. With easy imitation the effect is only more pronounced, which provoked a question whether and how would the impact of unequal profit constraint be affected by CF networking? It turns out that,

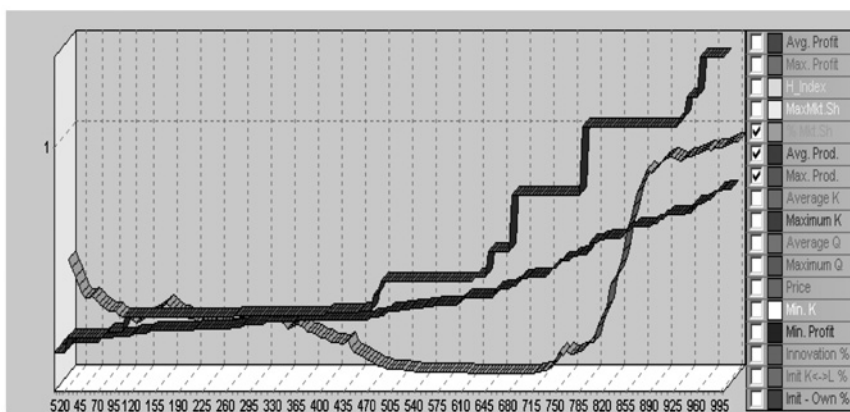
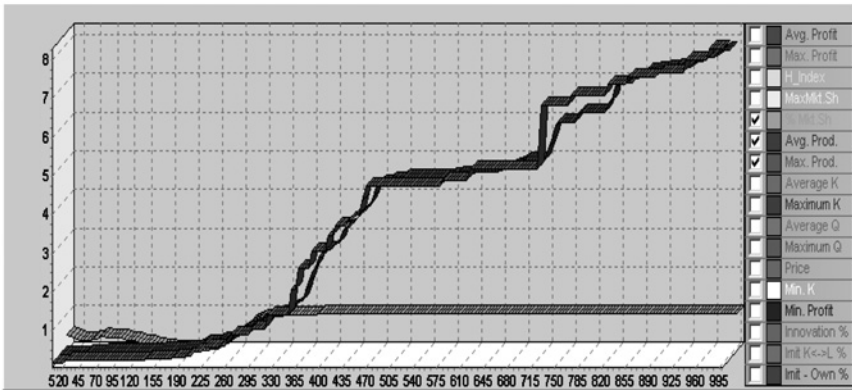


Fig. 13. Maximum Productivity, Market Share and Average Productivity for IOF When Depreciation Rate is High (5%) and High Innovation Rate (2.05). No Imitation.



*Fig. 14.* Maximum Productivity, Average Productivity and Market Share for IOF When Depreciation Rate is High (5%) and High Innovation Rate (1.33), with Own Imitation.

under the settings of the model, and with negligible own imitation among IOFs, all IOFs would be driven out of the market, with remaining CFs supplying the output with very close distribution of market share (Herfindahl index 0.15). This result suggests that, under certain conditions, the survival of smaller CFs may be made easier by their close networking and sharing of technology, even when an industry is dominated by large capital-owned firms.

All the above results of simulations rest on the assumption of no entry. If new firms are entering the industry, and in particular if they bring new technology and gain market share, it would change the industry dynamics. That remains one of the tasks for further research.

#### 4. CONCLUSIONS

Labor management literature has long been dealing with the question why labor-owned firms are so rare in market economies. Their social impact, their positive effect on productivity, and workplace democracy are only some advantages of labor-owned firms described in the literature. Numerous obstacles have also been examined, both in theoretical and empirical studies of labor-owned firms. Some of the most studied disadvantages, relative to capitalist firms, are the under-capitalization of CFs, governance, and

incentives problems. It is a known fact that CFs enter the market more infrequently than IOFs, they remain small, and they tend to operate in labor-intensive industries. In this paper we have examined the impact of research and development and innovation patterns of the two types of firms, looking for further explanations of the rarity of worker cooperatives. Our model remains general, and its conclusions can be extended to small family businesses, for example. However, the institutional environment of CFs lends itself to the assumption of increased networking within a group of firms as a possible survival strategy.

We used the [Nelson and Winter \(1982\)](#) type of a model of an evolving industry, with the addition of learning by GA. Firms choose their R&D investments in a process of learning from past decisions and profitability of those decisions. The two types of firms in our model differ in their innovation focus, since IOFs concentrate on capital technology, while CFs are concerned with labor technology and organizational innovations. We examined the impact on the market share of two groups of firms under the condition that equal technology is readily available to the group, and that other group's technology is emulated at a cost. Our simulations capture some patterns that may lead to a decline of market share for a group of firms. While a multitude of random events may shape the outcomes, some patterns emerge. One important result captured by the model is the link between group market dominance and market concentration. We suggest that the dominance of a group of firms can more readily decline when the group emulates the technology of the other type of firms, if they have small market shares. Since CFs are typically small firms, it may be that their incidence is jeopardized by frequent attempts to emulate technology of other firms competing in the market. Creating networks of cooperatives proved to be an excellent survival strategy, under the conditions of the model. Based on a premise that CFs may network more, in light of the principle of cooperation among cooperatives, while IOFs may innovate more given their access to capital, conditions of survival of the CF group are explored. We simulate two types of industries – one with low levels of R&D, and one with high levels. Our results suggest that cooperation among equal firms is a good strategy for survival and substantial market presence, especially in low-R&D industries, and that the greater the degree of interconnectedness, the more likely is the group's survival. CFs will lose their market share in industries with pronounced R&D activities if they innovate at half the rate of IOFs, unless they form very close technology networks, which are not available to the competing group. Therefore, easy transfer of knowledge and

technology among CFs may be their path to success, even when they cannot keep up with innovation levels of more profitable IOFs.

We also examine how the model behaves when some “stylized facts” are included in simulations. Facing costly inputs will cause the CF group’s marginalization, but closer clustering within the group may alter that outcome. We consider high capital depreciation rates and higher profit margins for IOFs as a possible reason for their bankruptcy, but, while some firms may have to leave, the key to the group’s survival is in higher innovation rates and high concentration. This result suggests that without relatively high innovation rates a group is more likely to dissolve. Further, market dominance is more probable if growth of a small number of industry leaders is encouraged, and technology is easily emulated within the group.

The one-input model we have used in this paper is very general, but a degree of input substitutability, a mix of different types of innovations, and different market conditions would likely alter some of the results. In the future version of the model, we need to examine the impact of entry under different conditions to capture both the creation of new firms and conversion of firms into a different type. A more sophisticated learning model is also an intended extension.

## NOTES

1. Other types of cooperatives (consumer cooperatives, credit unions, housing cooperatives, etc.) are more prevalent throughout the world, while worker cooperatives remain relatively rare. The question raised by economists is why capital hires labor in market economies more often than the other way around, and that remains our focus here.

2. This concept is supported by [Bonin \(1983\)](#), for example.

3. Controlling inputs are capital for the IOF, and labor for the CF since owners of those inputs control the firm (see [Dow, 2003](#) for example).

4. For a summary of NW model characteristics see [Andersen \(2001\)](#).

5. Genetic algorithm ([Holland, 1975](#)) is an evolutionary algorithm, where a set of alternative solutions (strings) are explored in parallel, and in a process of the survival of the fittest, the best rules predominate in the population. We apply the GA with self-generated parameters ([Novkovic & Sverko, 2003](#)).

6.  $\sum s_i^2$ , where  $s_i$  is a fraction (firm  $i$  share in total output), normalizing the index to a range [0,1].

7. ICA principles of cooperation, 1995.

8. Bankruptcy condition is  $K < K_{\min}$  ( $L < L_{\min}$ ).

9. Innovation ratio is calculated as the number of innovations by IOF divided by the number of innovations of CF in 1000 generations.

## REFERENCES

- Andersen, E. S. (1998). The evolution of the organization of industry. DRUID Conference on Competencies, Governance and Entrepreneurship. Bornholm, 9–11 June.
- Andersen, E. S. (2001). Toward a multiactivity generalization of the Nelson–Winter Model. 2001 Nelson and Winter Conference 12–15 June, Aalborg, Denmark.
- Ben-Ner, A. (1984). On the stability of the co-operative form of organization. *Journal of Comparative Economics*, 8(3), 247–260.
- Ben-Ner, A. (1988). Comparative empirical observations on worker-owned and capitalist firms. *International Journal of Industrial Organization*, 6, 7–31.
- Ben-Ner, A., Montias, J. M., & Neuberger, E. (1993). Basic issues in organizations: A comparative perspective. *Journal of Comparative Economics*, 17, 207–242.
- Blasi, J., & Kruse, D. (1991). *The new owners: The mass emergence of employee ownership in public companies and what it means to American business*. New York: HarperCollins.
- Bonin, J. (1983). Innovation in a labor-managed firm: A membership perspective. *The Journal of Industrial Economics*, 31(3), 313–329.
- Bonin, J., Jones, D. C., & Putterman, L. (1993). Theoretical and empirical studies of producer cooperatives: Will ever the twain meet? *Journal of Economic Literature*, 31, 1290–1320.
- Craig, B., & Pencavel, J. (1993). The objective of worker cooperatives. *Journal of Comparative Economics*, 17, 288–308.
- Dow, G. (2003). *Governing the firm: Workers' control in theory and practice*. Cambridge, UK: Cambridge University Press.
- Fagerberg, J. (2003). Schumpeter and the revival of evolutionary economics: An appraisal of the literature. *Journal of Evolutionary Economics*, 13, 125–159.
- Hansman, H. (1996). *The ownership of enterprise*. Cambridge, MA: Harvard University Press.
- Kwasnicki, W., & Kwasnicka, H. (1992). Market, innovation, competition: An evolutionary model of industrial dynamics. *Journal of Economic Behavior and Organization*, 19, 343–368.
- Nelson, R., & Winter, S. (1982). *An evolutionary theory of economic change*. Cambridge, MA: Harvard University Press.
- Novkovic, S., & Sverko, D. (2003). A genetic algorithm with self-generated random parameters. *Journal of Computing and Information Technology*, 11(4), 271–284.
- Pérotin, V. (2004a). Early cooperative survival: The liability of adolescence. *Advances in the economic analysis of participatory and labor-managed firms*, 8, 67–86.
- Pérotin, V. (2004b). Entry, exit and the business cycle: Are Coops different? Presented at the panel session on Employee Ownership of the Association for Comparative Economic Studies in San Diego.
- Stewart, G. (1991). Strategic entry interactions involving profit-maximizing and labour-managed firms. *Oxford Economic Papers*, 43, 570–583.
- Vanek, J. (1970). *The general theory of labor-managed market economies*. Ithaca, NY: Cornell University Press.
- Van Someren, T. C. R. (1992). Emulation and organizational change. In: F. M. Scherer & M. Perlman (Eds), *Entrepreneurship technological innovation and economic growth: Studies in Schumpeterian tradition* (pp. 201–217). Ann Arbor: The University of Michigan Press.
- Yildizoglu, M. (2002). Competing R&D strategies in an evolutionary industry model. *Computational Economics*, 19, 52–65.



## APPENDIX

Initial parameter values are equal for both types of firms, unless otherwise specified in the text. *Note:* GA strategies represent the number of strings attached to each firm, from which the best one is chosen every  $r$  periods.

Initial Parameters	Values
Capital (labor)	50
Productivity	0.16
Cost per unit of $K(L)$	0.1
Demand	100
Elasticity	1
$rd_{\min}$	0.01
$K$ -depreciation ( $L$ -attrition)	0.03
$r$	5
$K_{\min}(L_{\min})$	0.001
GA-crossover sites	1
GA-number of strategies (strings, or chromosomes)	30
Number of genes	12
Number of generations	1,000

# SELF-FINANCING IN LABOR-MANAGED FIRMS (LMFS): INDIVIDUAL CAPITAL ACCOUNTS AND BONDS

Ermanno C. Tortia

## ABSTRACT

*The literature on labor-managed firms identifies the source of undercapitalization in the Furubotn–Pejovich effect. Appropriate capital accounts can counteract the horizon problem, but they engender little-examined problems connected with the distribution, reinvestment, and reimbursement of net surpluses. This paper proposes that the introduction of cooperative bonds would provide a better match between the horizons of members and their firms. However, bonds generate risks of their own due to capital variability, thus requiring the imposition of various constraints and the retention of appropriate levels of collective reserves. Finally, a hierarchy of liabilities is proposed to protect parties who undergo information disadvantages.*

“In constraining any system of government and fixing the several checks and controls of the constitution, every man ought to be supposed a knave and to have no other end, in all his actions, than private interest.” David Hume (1740)

“... most of our institutions ... are indeed reasonably robust against exploitation by individual sociopaths who care about absolutely nothing but their own inclusive fitness, but would break down entirely if everyone were like that.” Paul Seabright (2006)

## 1. INTRODUCTION

The problem of the accumulation of capital in labor-managed firms<sup>1</sup> (LMFs henceforth) has been widely studied in the specialized literature. Worker-members in LMFs have a truncated temporal horizon of permanence in the firm, and when self-financed funds cannot be recouped on quitting the organization, members will anticipate the unrecoverability by reducing self-financed investments to an inefficient level. Most scholars recognize the existence of a tendency for underinvestment. However, not all authors agree on the matter, and some prefer to treat it as substantially irrelevant. At the empirical level it is difficult to isolate the effects of the institutional variables responsible for its existence, though some empirical tests support it. The main institutional variables are identified as being property rights, and the governance of the organization. Other variables, such as the tax system, may have distorting effects on the basic institutional mechanisms.

This paper states the problem of underinvestment in LMFs as it was initially formulated by Furubotn and Pejovich and by Vanek in 1970. Starting from the reasons for the suspicion that capital funds are misallocated in LMFs, it surveys some noteworthy empirical tests and then focuses on institutional factors leading to under-capitalization, and on possible solutions.

The first part of the argument relies on the basic mechanisms regulating the introduction of individual reserves of capital, which are defined as claims over the capital stock owned by the firm, hence individual property rights over a fraction of that capital.<sup>2</sup> This institutional device is thought to be a solution to the problem of the truncated temporal horizon, since members would recoup individually invested capital at some point in time. The introduction of individual reserves also has important productivity-enhancing potentials because it engenders higher worker involvement at the financial level. In the version of individual reserves advocated by the paper, labor remuneration would be increased by shares of the net residuals, and workers would receive a larger part of the value-added of the firm. However, individual reserves have two critical aspects that need to be considered

carefully: (1) the mechanisms for distribution and reinvestment of the net residuals, and (2) the mechanisms regulating the reimbursement of individual capital stakes. Various asymmetries between labor-managed firms and capitalistic firms will be highlighted in order to show the distinctive nature of the distribution of value-added and the accumulation of capital in LMFs.

Cooperative bonds constitute a further device with which to improve a firm's ability to manage the self-financed accumulation of capital and the reimbursement of individual capital accounts invested in the firm. If quitting members have the right to sell their individual stakes on regulated markets, the firm will no longer be forced to pay them back shortly after their departure. A first risk connected with the introduction of saleable bonds is the transformation of a conspicuous part of the firm's capital into debt held by external financiers. A second risk is the strategic behavior of better-informed members, who may leave the organization when negative economic prospects are envisaged. In order to curb the risks deriving from the transformation of ownership into external finance, and from strategic quitting, various conditions for the firm's financial stability are likely to be needed, such as an upper bound on the percentage of capital held by bond owners and a hierarchy of liabilities that prioritize the reimbursement of titles held by less informed financial stakeholders.

The organization of the paper is as follows. Section 2 highlights the roots of the phenomenon of underinvestment and under-capitalization in worker cooperatives, as stated by the traditional literature on the topic.<sup>3</sup> Section 3 introduces the question of how individual reserves should be structured starting from their institutional underpinnings. Section 4 endeavors to furnish a more precise institutional proposal concerning the introduction of bonds in LMFs. Section 5 concludes.

## **2. MEMBERS' TEMPORAL HORIZON IN LABOR-MANAGED FIRMS**

Since the studies by [Furubotn and Pejovich \(1970\)](#) and [Vanek \(1970, 1975\)](#), the literature on LMFs has devoted considerable attention to the problem of capital accumulation. The focus has been on the existence of a truncated temporal horizon for worker-members in LMFs as a source of the inefficient allocation of self-financed investment funds.

[Furubotn and Pejovich \(1970\)](#)<sup>4</sup> consider a model of LMF that can be termed "socialist" ([Horvat, 1984](#)) in that capital assets are publicly owned,

i.e., worker-members are not allowed privately to appropriate the net residuals, which are necessarily reinvested in the firm. Members can only benefit from distributed returns on investments taking the form of labor income. Hence, the system is defined as a kind of *usufruct* of socially owned capital assets, and accumulates self-financed capital by means of reserves, which are collectively managed, but not owned, by the membership of the organization. Reserves are non-distributable to members either now or in the future, and non-redeemable when members leave the organization.<sup>5</sup> Firms are financed by two main means: bank loans, and self-finance through reinvested net residuals.

Worker-members of cooperatives receive an ordinary income (wage) from the firm's proceeds, and they can use their savings to make two kinds of investment decision. The first is an investment in non-owned assets consisting of the cooperative's profits. The second is an investment in owned assets that workers can finance out of distributed labor income (wages) and save on individual bank accounts. The former type of investment is not redeemable and does not yield an individual return to members, while the latter can be recouped and yields fixed returns. Hence, workers are induced to compare the returns on the two types of asset at the margin.

Assuming that all workers have the same preferences concerning investment projects, and that they all expect to remain in the firm for the same amount of time, the following formula can be used to calculate the returns on each type of investment necessary to make workers indifferent between them (Zafiris, 1982):

$$PV_{LMF} = a_{LMF} \sum_{t=1}^T \frac{1}{(1+i)^t} = 1 \quad (1)$$

where  $PV_{LMF}$  is the present value of the self-financed investment owned by the cooperative,  $a_{LMF}$  is the return yield by the investment in one period of time: this represents the rate of indifference between investments in owned and non-owned assets (the *hurdle rate*), since when it is too low and  $PV_{LMF}$  is lower than 1, workers will prefer investments in owned assets.  $T$  is the members' temporal horizon, which is identified with the temporal horizon of the median members when preferences are heterogeneous, and  $i$  is the rate of time preference that equals the interest rate paid by bank deposits at equilibrium. In the case of a 1 dollar investment,  $a$  is equal to the internal rate of return gross of depreciation. If the investment is to be undertaken, its present value needs to equal its initial value (1 in our example).

The same results are obtained by calculating the sum in Eq. (1):

$$a_{LMF} = \frac{i}{1 - (1 + i)^{-T}} \quad (2)$$

Eq. (2) shows that  $a_{LMF}$  is always greater than  $i$  and approaches  $i$  as the members' temporal horizon increases and tends to infinity (which obviously cannot be the case). LMFs tend to select only the projects with the highest returns down to the hurdle rate. Investments in productive assets are positive, but the system allocates investment funds inefficiently because Pareto-superior allocations are still available. In this respect LMFs are Pareto-dominated by capital-managed firms (CMFs henceforth) because share ownership in CMFs guarantees the acquisition of returns arising out of self-financed investments virtually ad infinitum, i.e., without any temporal horizon throughout the duration of the firm itself. At equilibrium, CMFs select all the investment projects that yield a return superior or equal (where equality is obtained for the marginal investment) to the market interest rate. CMFs extract all the possible rents accruing to the firm's operation and have an incentive to do so by using their own funds. Total returns on productive assets will be lower than the socially optimal returns obtainable by CMFs.

The limited convenience to LMFs of reinvesting their profits may be balanced by access to external finance in the form of bank loans. However, the comparative disadvantage with respect to CMFs can never be eliminated because mis-allocated self-financing implies a reduced capacity to build equity and collateral (Vanek, 1970). LMFs will suffer two disadvantages: the first due to their unwillingness to reinvest their net revenues in the firm; the second due to their limited ability to guarantee loans.

Although some authors (Horvat, 1986a, 1986b) have preferred not to recognize the significance of the horizon problem in LMFs, most of the literature insists on its importance, and other authors, for example Furubotn and Pejovich (1970) and Milanovic (1983), consider the horizon problem to be fatal. They seek to demonstrate that LMFs reach a Pareto-optimal allocation only in exceptional cases, whilst inefficient allocation is the rule. The exceptionality of efficient solutions coupled with the uncertainty characteristic of investment decisions in market settings and of the permanence of worker-members in LMFs is one of the main reasons why worker co-operatives are rare in market economies and concentrate in labor-intensive industries.<sup>6</sup>

The empirical evidence concerning under-capitalization is quite supportive of, but not fully consistent with, these theoretical conclusions. Horvat

(1986a) and Milanovic (1983) found that Yugoslav firms had a pronounced propensity to increase their debt with respect to owned resources. However, in the case of Yugoslavia, reinvestment of positive results was mandatory, and any reduction in the capital stock was forbidden. These factors may explain why loan financing was preferred in many circumstances. Members of cooperatives knew that they could not distribute net residuals even when new investments were not necessary. On the other hand, the obligation to maintain the book value of the capital stock reduces self-financed investments since members know that they will have to maintain the value of the capital stock even if they quit the organization, thus violating their time-horizon constraint. In the presence of such restraints it is convenient to inflate costs (for example wages paid over the year), thereby reducing net results and increasing the need for external finance.

To my knowledge, the best empirical tests of the hypothesis of undercapitalization have been performed in Western countries. The study on plywood cooperatives in the US Pacific Northwest (Berman & Berman, 1989), which are characterized by the presence of a market for membership rights,<sup>7</sup> compared them to similar capitalist firms in the same sector and geographic region. The authors estimated a production function on the basis of balance-sheet data and tested all the main implications of the standard version of the Ward (1958) model. Cooperatives operated at constant returns to scale, since production took place at the point of minimum average costs. This evidence was coupled with a lower capital to labor ratio, a higher marginal product of capital and a lower marginal product of labor in cooperatives with respect to capitalist firms, at least in the short run. Hence cooperatives fully exploited their capital stock while capitalist firms may have been inefficiently overcapitalized. Indeed, capitalist firms can be thought to underutilize labor. In many instances, collective bargaining may push the wage above its true social cost, so that capitalist firms use too little labor and too much capital, favoring the growth of unemployment at the macro level. On the other hand, the same evidence does not eliminate the under-capitalization hypothesis, since, for example, it does not show that cooperatives are able to enter capital intensive sectors. On the contrary, it shows that cooperatives invest less than do capitalist firms, and that they may self-select themselves in labor-intensive sectors in specific cases where higher marginal returns to capital match a higher return to investments required by the truncated temporal horizon. When constant return to scale are reached for higher levels of capital intensity and lower marginal returns to capital, LMFs may not find it convenient to invest enough because of the Furubotn–Pejovich effect.<sup>8</sup>

These results have been partially confirmed by [Bartlett, Cable, Estrin, Jones, and Smith \(1992\)](#), who examined a matched sample of Italian industrial firms, coupling cooperatives with capitalist firms of similar characteristics. The Italian environment is characterized by the absence of a market for membership shares, which is forbidden by law. Until the time of the study, Italian cooperatives had accumulated capital almost exclusively by means of collective reserves, plus bank loans, even if members held individual capital accounts of limited amount, and loans supplied by cooperative members were allowed. [Bartlett et al. \(1992\)](#) found a significantly lower ratio of fixed assets per head in cooperatives, which suggested the use of more labor-intensive production processes. Lower capital intensity was offset by significantly higher labor productivity favored by a lower incidence of managerial workers, strikes, and worker turnover.<sup>9</sup> In addition, the depreciation rate of fixed assets was lower in capitalist firms and may have signaled a shorter time horizon for the turnover of capital equipment in cooperatives, since depreciation costs were higher. Cooperatives showed a similar, though slightly lower, ratio of internal funds to total capital (about 50%) to capitalist firms. However, once member loans had been accounted for, the ratio of debt per head was significantly higher in cooperatives. Moreover, the Italian tax system for cooperatives, which strongly encouraged the accumulation of collective reserves, may have played a role in sustaining the accumulation of internal funds. Although strong evidence of under-capitalization was not found, and cooperatives had been able to grow despite the absence of tradable shares, differences with respect to capitalist firms were systematic.

In a recent study, [Podivinsky and Stewart \(2006\)](#) analyze the process of entry by LMFs in the UK economy between 1981 and 1985. They model the entry process using the Poisson and the negative binomial distributions. Econometric estimates of both these models point to the conclusion that LMFs enter markets characterized by lower capital to labor ratios and by lower economic risk, measured by the dispersion of profits in the industry. The result is extremely significant from a statistical point of view, and it induces the authors to conclude that a lack of financial resources accounts for the failure of LMFs to spread in market economies over the last 150 years, ever since the earliest cooperative experiments. Later sections in this paper will state the reasons why the proposed systems of individual reserves and bonds can help resolve the problem of both the lack of financial resources and the low degree of economic risk accepted by LMFs to date.<sup>10</sup>

The results of empirical research support the contention that worker cooperatives self-select themselves in industries where they can compete with capitalist firms. Such industries are characterized by relatively low capital



intensity and economic risk (Ben-Ner, 1988). When economic risk is not too high, financial shortcomings can be compensated by cooperative advantages, for example higher labor productivity favored by *x*-efficiency (Leibenstein, 1966), i.e., organizational efficiency due to higher involvement and participation. However, such compensation is limited, and when the financial disadvantage is too pronounced, cooperatives may be forced out of the market or transformed into capitalist firms. In Italy, for example, many cooperatives have had the possibility in recent years to resort to financial instruments drawn from the capitalist environment in order to withstand competition by international companies, or to enter capital intensive sectors (Mazzoli, 2005). However, the same results concerning under-capitalization have not been obtained for the Mondragon cooperatives (Thomas & Logan, 1982), which do not show signs of under-capitalization with respect to capitalist firms of similar size. This finding is crucial for the development of my argument, since the Mondragon cooperatives are characterized by the presence of (partly) individual reserves of capital, which greatly increase their members' financial involvement, though no tradable shares are allowed.<sup>11</sup>

### 3. INDIVIDUAL RESERVES IN LABOR-MANAGED FIRMS

Individual reserves, i.e., a system of individual capital accounts appropriable by worker-members at some future point in time, are a viable solution to the problem of unrecoverability, since they do not suffer from the Furubotn–Pejovich effect because invested funds are recouped by members.<sup>12</sup> In order to achieve equivalence between the present and future ownership of invested funds, it is sufficient to remunerate them at the rate of time preference between present and future consumption.

The following exploration of the problems linked with the introduction of individual reserves starts from the background institutions that support and influence the accumulation of capital in LMFs, primarily property rights. Some shortcomings of the proposal are examined, and possible solutions are suggested.

Hansmann (1988, p. 269, 1996) defines the ownership of a firm as the coupling of residual rights of control with the right to appropriate the net residual.<sup>13</sup> The former refers to the owners' authority in all events not explicitly covered by the contracts signed by the firm, especially labor contracts. In the presence of incomplete contracts, an uncertain economic

environment, and non-standardized tasks, residual rights of control will necessarily grant some degree of discretionary power in the management of the firm. The latter is a consequence of the former (Putterman, 1988; Dow 2003)<sup>14</sup>: if the firm's owners are to control all non-contracted operations, they will also decide on the destination of the residual, which is non-contracted by definition. As a consequence, in the general case the two rights are bundled together.<sup>15</sup>

Application of Hansmann's definition to labor-managed firms yields important implications. In LMFs members enjoy residual rights of control. The residual has the economic nature of labor remuneration since labor as a production factor is entitled to decide its destination. Capital remuneration may be above the market interest rate because of the higher financial risk undergone by individual capital stakes as compared to standard loans. However, it is contracted ex-ante. Investors may appropriate part of the net residual as well, but this appropriation by non-controlling stakeholders must be subjected to contractual agreements reached over and above property rights, which are assigned to worker-members. Since ownership of the firm does not give them the right to appropriate the residual de jure, their participation must be regulated. The same happens in the case of CMFs for stock options, profit sharing, and ESOPs (inverting the roles of investors and workers).

Appropriation by worker-members of the net residual generates a search for workable reinvestment mechanisms compatible with LMFs property rights. If individual claims on the net residual are allowed, it will have to be shared among members according to some kind of rule. Because the net residual has the nature of labor income, it must be distributed as an extension of the current part of labor income already paid during the accounting period. At the empirical level, the tradition of cooperative movements comprises a number of institutions that act in this manner. In Italy, for example, cooperatives can distribute part of the net residual to members under the heading *ristorni*, which have recently been reevaluated by legislation. The same rule is followed by the Mondragon cooperatives.

The end-of-year extensions of current labor income constitute additional remuneration for workers, which is not paid to employees in capitalistic firms. Workers' incomes will include a contracted part, similar to the wages, and a residual part which is more similar to dividends paid out to shareholders in CMFs.<sup>16</sup> Hence, end-of-year residuals shareable among worker-members can be defined as the net income remaining after all contractual obligations have been honored, and among these obligations is also the payment of the current part of labor remuneration, and of capital remuneration.

End-of-year residuals can be paid out in cash and represent additional current income, or they can be reinvested in the firm. In the latter case, they serve a first crucial function: the self-financing of risky investment projects. When there is a history of accumulation of residuals, reserves of capital are created. The part of the net residual partitioned among members will be held in individualized accounts, which are owned by individual members. The part of the residual saved in collective reserves of capital will be owned by the firm and, as a rule, not disposable by members. Cumulated individualized capital accounts serve other important functions: they constitute the collateral needed to obtain credit from financial institutions; they buffer workers against short-term fluctuations in the firm's revenues, thus limiting excessive fluctuations in current labor income; they are liable to absorb negative economic results such as losses. Hence, in many cases, workers do not appropriate shares of the net residual in cash but must reinvest them.

The reinvestment of the residual shares may encounter an obstacle in the form of *free-riding*. If the decision on what proportion of the shares is to be reinvested in the firm is left entirely to individual members, free-riding is likely to ensue. The collective of members as a whole has an interest in investing the optimal amount of money because it will receive the maximum benefit from doing so, and it will be able to maximize the collective wealth. However, each individual member may prefer to cash it in and put it to other uses. This problem can be equated to the production of common goods, i.e., specific goods that are shared and beneficial for all (or most) members of a given collectivity. Common goods are rivalrous, but not excludable.<sup>17</sup> The net residual in LMFs is clearly rivalrous. It is not excludable, however, since, in most cases, distributive rules are fixed for the entire membership and exceptions would not be accepted by the members. Non-excludability is the primary source of free-riding. At the empirical level, the best example is provided by the constitutional rules in Mondragon cooperatives, which impose the compulsory capitalization of all positive residuals.<sup>18</sup>

Individual shares of net residuals, when used to self-finance a firm, can be equated to a form of equity capital<sup>19</sup> since they perform the same functions as the latter. However, differences with respect to equity in capitalist firms should be borne in mind: first, they are remunerated by a fixed interest rate, while equity capital in CMFs receives the full residual (profit); second, they can be recovered, and their circulation in the market in the form of equity shares is often not allowed because their accumulation is linked to the worker's personal position as a member of the cooperative.<sup>20</sup>

Worker-members must necessarily quit the firm at some point in time, renouncing their right to any form of labor remuneration. Furthermore, quitting members lose their share of control over the firm. Control and risk-bearing are necessarily linked because a lack of control implies that it is impossible to shield against economic risk when capital shares are at stake in the organization. Consequently, quitting members are not in a position to accumulate new equity capital and to exert control over the use of the accounts accumulated in the past. These problems are absent in CMFs because, in their case, capital shares are not linked to the positions of individual members, and they can be sold at a price mirroring the present value of future returns on the firm's investments.

For these reasons, the majority of cooperative models, for example the Italian, the French and the Spanish legislations, require cooperatives to pay back individual shares of capital to quitting members. This legal obligation engenders the phenomenon of capital variability, since the part of the capital held individually by members is not fixed, as happens in CMFs. It varies with members' turnover.<sup>21</sup> Equity capital variability may be a serious financial obstacle for cooperatives, which in this regard are usually considered to be at a disadvantage with respect to capitalistic firms. The compulsoriness of reimbursement may weaken the financial structure of the firm if numerous owners of important shares of capital quit the firm over a short period of time. Moreover, capital variability reduces the firm's ability to guarantee external loan finance with its own collateral.

Financial instability due to labor turnover may, in the most extreme cases, lead to financial distress. Issues concerning asymmetric information and moral hazard must be taken into account as well. If members have access to privileged information on the economic and financial position of the firm, they may decide to quit strategically in order to have their accounts reimbursed before other liabilities come to the point of restitution, thus aggravating the crisis. Prediction of this kind of event induces many cooperatives not to accumulate individual reserves and the legislator to support the accumulation of collective reserves. This is the case, for example, of Italian cooperatives, where the shares of the net residual attributed to members have been, in most cases, tiny or nil.<sup>22</sup>

The main alternative to the reimbursement of individual shares is the creation of a market for membership rights (Dow, 2003) where quitting workers can sell their positions as members of the cooperative to incoming members. Dow (1996) shows that, at equilibrium, this solution would have the same efficiency features as markets for shares in capitalist economies. However, empirical evidence, for example concerning the US plywood

cooperatives, and theoretical speculation suggest various imperfections that represent serious obstacles in the implementation. The main shortcoming is the difficulty of finding suitable new members willing and able to buy the membership position: they must be accepted by incumbent members and, at the same time, wealthy enough to afford the price of the position. Besides, prices for membership positions may be extremely high in capital intensive sectors and asymmetric information is likely to play a role in limiting the effectiveness of this system, typically through a conspicuous reduction in the market price, which can prove to be well below the “true” economic value of the position. Indeed, most plywood cooperatives in the USA have been sold to capitalist companies after being active for roughly half a century. In order to remedy these shortcomings, a mixed system, which will not be fully elaborated here, can be envisaged. The sale of the membership position at its market value can be allowed, while retaining all the other institutional features concerning reimbursement. The quitting member would have the option of selling his/her position to a newcomer conditional on the acceptance of the new member by the incumbent membership. On the other hand, if either the quitting member is not able to sell his/her position profitably or the incoming member is not accepted by incumbents, the reimbursement option takes over, and the firm will need to pay the individual capital share back at its (reevaluated) face value, since in the latter case the market price of the position will not be determined. This mixed solution would have at least three important advantages:

1. It would be convenient for both the quitting member and the firm: if the former is able to sell his/her quota profitably, the latter does not have to pay it back, provided the incumbent membership deems admission of the incoming member to be appropriate;
2. It would evade the traditional limitations of the market for membership positions since the reimbursement option would still be mandated in the absence of suitable incomers. It can be easily predicted that the market for membership positions would retain an important role in small cooperatives, where personal relations are paramount and the market value of individual positions is not too high. On the other hand, in large and capital intensive cooperatives the average value of positions would be higher and more difficult to price. Hence reimbursement, possibly through financial intermediaries, may tend to prevail;
3. It would further spur involvement in the organization and productivity, since incumbent members know that they will be able to sell their individual share profitably only if the firm is in good economic and financial shape.

#### 4. THE STRUCTURING OF INSTITUTIONAL SOLUTIONS: COOPERATIVE BONDS

Systems of individualized capital stakes are found in many instances of national legislation. Among the best known, the Italian and the Mondragon systems are both characterized by the presence of individual shares. In the Italian case individual stakes (*capitale sociale*) are quite loosely regulated, and the main constraint is an upper bound on the rate of remuneration. In most cooperatives, individual stakes, though their presence is mandated by law, represent a tiny fraction of the firm's entire capital. In the Mondragon case the role of individual capital shares is substantive, since, on average, half of the net residuals are allocated to individual accounts capitalizing the member's financial position. In both cases individual stakes cannot be paid back to incumbent members or sold, but must be reimbursed by the firm to the member upon quittance or retirement. The innovative contribution of this paper lies in the improvement and development of this basic scheme. The objective is to render this kind of system more robust with respect to capital variability and worker turnover. If capital stakes are transformed into debt held by terminated members or by external investors, and not reimbursed immediately, a first step is taken toward stabilizing the capital of the firm. As well known, the Mondragon system developed in an economic environment characterized by low labor mobility and high unemployment, and which was consequently static (Thomas & Logan, 1982). This situation may have favored the introduction of a large quota of individualized capital since turnover was virtually nil throughout the life of this group of cooperatives. One of the main reasons why the replication of the Mondragon experiment has proved extremely difficult can be that in more dynamic systems characterized by low unemployment and high turnover, such as metropolitan ones, capital variability may be an insurmountable financial problem for cooperatives seeking to accumulate individual capital stakes, and thereby escape the Furubotn and Pejovich trap. The more robust the new mechanisms in counteracting financial instability the more likely the spread of LMFs in dynamic economic settings.

When part of the net residual is distributed individually and reinvested in the firm, the Furubotn–Pejovich effect seems irrelevant even if a fixed minimum amount of collective reserves is mandated constitutionally<sup>23</sup> but the marginal project is financed through redeemable individual capital accounts. In this case, the return used to evaluate the marginal project is the opportunity cost of funds for individual members, namely what they can get through private savings on an outside market. Hence the LMF should

choose exactly the same investment projects as a capitalist firm – the collective reserves function as a kind of lump sum tax.

The main solutions proposed in this direction are by Tortia (2002) and Zevi (2003, 2005). The first step is the transformation of individual capital accounts into debt to be repaid by the firm to quitting members. The problem of the lack of control by quitting members over risky capital stakes is thus solved. Furthermore, in the case of liquidation of the firm, the repayment of debt held by quitting members can be made conditional on the repayment of standard loans held by third parties (Cuomo, 2004). This arrangement is necessary because it limits the danger of diluting the right of third parties to have their credits repaid before equity.

As for the terms of reimbursement, the main possibilities are two:

1. *Extended terms for reimbursement.* Suitable longer terms for reimbursement may be devised to reduce financial pressures on firms and lessen the risks of members' moral hazard: if there is a long time span between quittance and reimbursement the possibility of strategic behavior is limited.
2. *Sale of the credit to financial institutions and circulation of bonds on regulated financial markets.* Quitting members could sell their credit to financial institutions (banks and other ad hoc institutions). This would be a step toward reconciling the firm's and members' interests. Members could increase their liquidity and firms would have longer terms for repayment. These financial instruments could be allowed to circulate in financial markets in the form of bonds. The market would fix the price of the title and, again, members would be able to increase their liquidity.

The first solution is simpler, at least at the level of its basic institutional mechanisms. Hence, attention will concentrate on the second solution.

#### *4.1. Reimbursement of Individual Accounts and LMF Bonds*

As a rule, individual accounts cannot be reimbursed while the worker is a member of the enterprise. This is a norm necessary in order to prevent a reduction in the members' financial involvement and in the firm's capital.<sup>24</sup> When the member quits, the controlling body may decide to reimburse his/her account immediately (for example when the value of the account is negligible), but it may also decide to retain that capital share within the firm. If the member is not allowed to sell his/her share of capital (first solution), a

reimbursement schedule must be established. It is possible to imagine the creation of independent bodies assessing (on request by the interested parties) the suitable duration of the reimbursement period given the share of the overall capital of the firm held by the member, and the firm's general financial conditions. The law may impose an upper and a lower time bound on reimbursement schedules.

If individual shares of capital can be sold to financial institutions and a market for LMF bonds is created (second solution), the reimbursement period can become much longer and encourage the undertaking of long-run investment projects. It is possible to imagine the payback process as lasting from 10 to 30 years or more, but it is also possible to envisage irredeemable bonds. Members will then be able to choose between sale and retention of their capital stakes. In the latter case, when their shares of capital are redeemable, they will have to wait for the fixed schedule term before they are reimbursed. When shares are irredeemable, members may either retain them and sell them at a future moment in time, or wait for the firm's liquidation. The economic risk linked to the sale of the bonds is borne by the quitting member. The issuing firm has to pay back the bonds at their face value (principal plus interests), but the members may well have to sell their bonds at a discount.

The market price of the bonds is what can be cashed by the worker. The main variable determining their price is the economic and financial strength of the issuing organization. If the firm is weak, the bond price may be much lower than its face value. In this case, it may be convenient, when the bond is redeemable, to wait for restitution at face value, or to be content with its yield when it is irredeemable. For redeemable bonds, when the time of restitution is approached, the market price should converge to the face value, unless the firm is unable to pay it back.<sup>25</sup>

The introduction of saleable bonds has the potential to spur individual effort, because members who quit firms in better economic and financial circumstances will be able to sell their shares of capital at higher prices (Zevi, 2003, 2005). Many individual members may not perceive the consequences of their increased effort on the value of their bonds, and may accordingly not increase their effort. However, in this way they act myopically. The corporate culture or even simple individual understanding may induce other members to pay closer attention to the results of their work activity, also with an eye on the value of their capital shares when they quit the organization.

If worker-members are entitled to sell their individual shares when they quit, a rule determining the minimum amount of equity held by incumbent



members is required. The reason for this is that if the bulk of the firm's capital is held by quitted workers (ex-members) or sold in the market, a dangerous separation between ownership (of the firm capital) and control (of the organization) will arise. The protection of the firm's creditors (e.g., banks) and its members' financial involvement would be too weak. Members may choose excessively risky investments if their financial stake is too small. The cost of the debt offered by financial institutions would increase, and rationing might arise because the firm would no longer be able to offer adequate collateral. Risks of default would increase as well, and the price of saleable shares would fall. The law of increasing risk would once again operate and LMFs would risk to be transformed into CMFs.

Since this kind of perverse dynamic may be triggered by members quitting strategically and selling their shares in the market before their price falls, it may be necessary to impose a restrictive rule: individual shares may not be sold if the percentage of capital held by incumbents falls below a minimum threshold. In the case of liquidation, buyers of LMF bonds and other creditors would be protected against members' morally hazardous behavior if the shares held by quitted members were reimbursed after liabilities toward third parties had been complied with.

Loss sharing is a further problem to be solved if the firm is to retain its financial equilibrium. Losses can be covered by collective reserves, but in some instances they may not be sufficient. Besides, some minimum level of collective reserves, not usable to absorb losses in advance of individual shares of capital, can be mandated by law. When losses are not absorbed by collective reserves, the individual capital shares held by incumbent members must be reduced. In this case, the possibility of reducing the value of titles held by terminated members and by bond owners can be considered as well. For example, with a 3-Euro reduction in shares held by incumbent members, the value of titles held by terminated members may be reduced by 2 Euros, and the value of bonds held by third parties by one Euro. This mechanism would entail:

- The redistribution of losses among all capital owners, without giving incumbent members an incentive to undertake excessively risky investment projects (they would still bear the worst consequences of negative economic results);
- The increased riskiness of cooperative bonds. The higher risk is likely to reduce the market value of the titles. However, the risks incurred by members during their work experience would be reduced if losses were borne also by terminated members and bond owners;

- The incentive to quit the firm in the presence of difficult economic conditions would be reduced, because members would know that they are not the only party suffering financial losses in the case of negative performance, and that they would incur losses even if they quitted the firm.

The mechanisms described in the preceding paragraphs would generate two new categories of stakeholders: terminated members (classified into retired and non-retired) and LMF bond owners. Given that they may undergo financial losses in the event of negative economic results, their stake in the firm is risky, and suitable participatory arrangements should be made: they may be given the right to be informed and consulted about the firm's financial policies, but without any formal right to manage it, so as not to dampen the membership control over the organization.<sup>26</sup> If the firm takes decisions risky for stakeholders other than incumbent members, the provision of suitable information may assist them in deciding about sale or retention of their titles. Conversely, consultation rights may induce the firm to refrain from unnecessary decisions dangerous to bond owners.

#### *4.2. Hierarchy of Liabilities*

An important requirement that ensues from the institutional mechanisms regulating individual reserves is that liabilities must be ordered according to their specific rights to reimbursement in the event of default or upon liquidation, for two reasons:

1. In the absence of a precise order in the rights to reimbursement, better informed subjects (the incumbents) may exploit their information advantage.
2. More closely involved subjects (again, the incumbents) bear the responsibility for strategic choices. They will have to bear the costs of wrong decisions before all the other financial stakeholders.

Hence, a suitable order of financial instruments must be devised in order to reduce the risks for less well-informed stakeholders. Among the financial instruments owned by the stakeholders, traditional loans must enjoy maximum protection and must be the first to be reimbursed. The creditors are usually financial institutions able to verify the firm's ability to repay loans. However, because they are purely contracted liabilities, without direct links with the firm's managerial choices, they should bear the minimum amount of risk.

LMF bonds sold in the market come second in the hierarchy of liabilities. They can be bought by subjects uninvolved in the firm's management. However, they are directly linked with the firm's risk capital because they derive from the sale of titles held by members. Moreover, they are conceived as risky financial activities that may be only partly reimbursed if the firm is unable to cover its losses with other means. Higher returns and lower prices will compensate for higher risks.

Third, retired members who decide not to sell their shares of capital should enjoy privileged reimbursement with respect to incumbent members. Retired members no longer take strategic decisions within the firm and should not bear the consequences of wrong decisions. This mechanism would create an incentive to stay with the firm and be loyal, because retired members enjoy a more secure financial position.

Individual shares held by quitted members and shares held by incumbent members should be the riskiest financial activities, and hence the last to be reimbursed when they are not sold, since they derive directly from strategic choices taken within the firms by subjects in possession of the best information concerning the firm's economic results and prospects. Finally, collective reserves can be used to pay back liabilities too. In the general case they can cover all the other liabilities, including the value of bonds and of the capital accounts held by quitted and incumbent members. However, when collective reserves derive from intergenerational transfers of funds, the possibility to use them to cover losses and other liabilities needs to be regulated, in order to prevent attempts to inflate costs and eat them up upon the liquidation of the firm.

Quitted members may decide whether to retain their stakes or sell them on the basis of the price that they can realize in the market. In the former case, the problem of the reimbursement of their shares relative to incumbent members arises. Quitted members have a strong relation with the firm's activity (their past work experience) but have more limited information than incumbents and do not bear responsibilities for recent strategic decisions. Their responsibilities for negative economic results are more limited than those of incumbents. Hence, preference could be given to their positions so that they enjoy privileged reimbursement with respect to incumbent members. However, other considerations suggest a different solution. First, loyalty to the firm should be rewarded, while premature exits should not be incentivized. Second, if quitted members enjoy privileged reimbursement, a strong incentive would be created for them to leave the firm when its economic prospects are negative, further weakening the firm's competitive potential and financial strength. If the riskiness of their financial stakes were

unchanged when they leave the firm, this incentive would be eliminated. Of course they could quit anyway and sell their shares, cashing them in at the market value and evading future economic risks. However, in this case, the market for LMF bonds would play a crucial role in curbing morally hazardous choices. If anomalous exits take place, market exchanges will tend to punish this behavior by increasing the discount rate applied to the sale of members' shares of capital. The discount rate may become so large that it discourages sale altogether. On the other hand, quitting the job may be a bad solution if firm-specific, at least partly sunk, investments in human capital have been made.

A final issue concerning the hierarchy of liabilities has to do with the restitution of individual capital shares. In the general case, the firm is not obliged to give back capital shares to individual workers while they are members of the firm. If members could freely dispose of their financial position while incumbent in the organization they could weaken the financial solidity of the firm. Even if they sold their stakes in the market for bonds without being reimbursed, external debt would grow relatively to owned capital. Besides, lack of involvement could induce workers to start excessively risky investment projects. Hence firms should retain incumbents' individual stakes in order to finance investments, to strengthen financial stability, and to reinforce members' involvement. However, managers may also decide to pay back part of individual stakes, and the majority of members may collectively decide to have part of individual accounts reimbursed, for example when overcapitalization is present or downsizing is needed. They may be allowed to do so, but only under stringent conditions. First, in the general case, the restitution cannot lead to a reduction of collective reserves when they have been accumulated by past generations of workers. Second, restitution can take place only when the ratio of the total amount of shares held by incumbent members to the total capital of the firm (collective reserves plus capital shares held by members – incumbent, quitted, and retired – plus bonds) is higher than the minimum required. Third, the ratio of capital to external debt must also be higher than the minimum. When restitution is decided, incumbent (and retired) members may be favored by being allowed to enjoy restitution before all other classes of financial stakeholder, for example before quitted members. Incumbents bear all the relevant economic risks, and are the least protected in the event of financial difficulties. This mechanism would represent retribution for risk-bearing. Moreover, it would be a further incentive to loyalty because only incumbent members could vote for restitution, while quitted members would lose this right. An incumbent member would weigh the possibility of

leaving the firm and selling his/her share at a discount against the possibility of staying with the firm and voting for partial restitution at face value.<sup>27</sup> At any rate, partial restitution of individual shares is likely to be a rare occurrence, given the requirement to respect stringent constraints on financial stability. Heterogeneous preferences among members would often preclude this possibility, since young incumbents would prefer to retain capital within the firm, even when members about to quit would prefer restitution. Furthermore, firm directors would often prefer a higher equity to debt ratio so that the firm's financial strength can be preserved.

## 5. CONCLUDING REMARKS

The Furubotn–Pejovich effect has been acknowledged by various authors as the main obstacle against the efficient allocation and accumulation of self-financed capital funds in labor-managed firms, when collective ownership of capital is accepted as the institutional standard. The literature on Yugoslav-type economic systems is thus able to explain the causes of undercapitalization and self-selection in labor-intensive sectors. However, the type of cooperative firm described by most studies is very specific and based on the usufruct of collectively owned capital funds. Hence, it should not be taken as a general pattern, and improvements are possible if new institutional devices prove effective.

In cooperatives where members need to accumulate equity capital, the introduction of individual reserves seems particularly promising among the proposals on how to correct the distortions caused by the Furubotn–Pejovich effect. This paper has concentrated on the potential problems arising from their introduction. Different property rights between capitalist and labor-managed firms give rise to fundamental asymmetries which are particularly marked as far as the mechanisms of distribution of the net residuals, the reinvestment, and the reimbursement of individual capital shares are concerned. Analysis of the problem shows that it is on these asymmetries that future research will have to focus if viable solutions increasing the growth potential of worker cooperatives are to be found.

The final section of the paper has examined the critical aspects of the conversion of individual capital accounts into titles saleable in the market for cooperative bonds; an arrangement which has the potential to solve the problem of capital variability. The main positive features of these mechanisms are the greater worker involvement at the financial level linked with the addition of shares of net residuals in labor remuneration, the elimination

of the horizon problem, and the curbing of morally hazardous behavior linked to capital variability. Besides, other positive potentials can be envisaged: LMF members have strong incentives not to default on bonds sold to cash out individual capital accounts previously held by retired members, because they themselves will want to cash out their own accounts in the future (when they quit or retire). Were they to default today, this would damage the reputation of the firm and make it harder to sell similar bonds in the future, which would reduce the market value of the individual capital accounts of the current members. Furthermore, the introduction of cooperative bonds, by eliminating the horizon problem, may counteract the main LMF shortcomings highlighted by many authors, and recently by Podivinsky and Stewart (2006): the purported inability of LMFs to enter capital intensive and economically risky industries. Individual reserves of capital would lead to an optimal or nearly optimal allocation of self-financed capital funds. In this way the firm could grow beyond the limited extent displayed by worker cooperatives to date. Larger self-financed funds would mean an improved ability to offer collateral and to obtain credit from financial institutions, thereby reducing the overall problem of undercapitalization. The increased amount of self-financed capital, and hence of collateral, would also offer new guarantees against the economic risk faced by worker-members. To be noted is that one of the main reasons why worker cooperatives were created in the first instance was to give members better job protection than employees in capitalist firms. Since the protection of employment is also an unavoidable constraint faced by cooperatives, but not present in capitalist firms, the lack of adequate internal funds and financial resources in general may force LMFs to enter less risky industries, where uncertain results do not endanger the firm survival and its jobs. Hence, the broader range of financial opportunities offered by the solutions proposed should also include a better ability to manage economic risk, although the possibility of gathering huge amounts of financial resources, which characterizes capitalist stock exchanges, would still be barred. Admittedly, this possibility would not be relevant to LMFs if they were able to grow adequately in capital intensive and risky industries. Indeed, the mechanisms regulating capital flow in capitalist stock exchanges have been criticized by various authors (for a survey see Keen, 2002) on the grounds that they would generate speculative flows and waste financial resources, since usually, and the more so during speculative bubbles, too many resources are invested in allegedly profitable ventures, while small firms not quoted on the stock exchange are deprived of adequate financial support. The mechanisms proposed by this paper have the potential to restrain these

kinds of speculative flows, because each cohort of worker-members in LMFs would appropriate only realized net residuals, not future ones. In the absence of financial instruments whose value mirrored the present value of future net results, such as capitalist shares, speculation would be frozen.

The main doubts relative to the introduction of a market for LMF bonds concern its sustainability. Although a certain degree of imperfection is intrinsic to any kind of market, excessively severe imperfections may prevent any market from operating. If LMF bonds prove too risky a financial tool, buyers will demand high discount rates. In this case, quitted members will have little or no incentive to sell their stakes, and they would have to accept the prospect of very long payback periods, often amounting to relinquishment of their ownership rights. The feasibility of the market for LMF bonds and the regulation of its working mechanisms constitute the substantial difficulty but also the potential innovativeness of this approach.

## NOTES

1. Meade (1972, p. 402) defines labor-managed firms as follows: "... a system in which workers get together and form collectives or partnerships to run firms; they hire capital and purchase other inputs and they sell the products of the firm at the best prices they can obtain in the market for inputs and outputs; they themselves bear the risk of any unexpected gain or loss and distribute the resulting surplus among themselves, all workers of any one given grade or skill receiving an equal share of the surplus; their basic objective is assumed to be to maximize the return per worker ... the workers may be hiring their capital resources either in a competitive capital market fed by private earnings or else from a central governmental organization which lends out the State's capital resources at rentals which will clear the market."

2. Generally speaking, three possibilities can be envisaged: reserves can be individual and appropriable; collective, but appropriable when the firm is shut down; collective and not appropriable at any point in time. This paper analyzes the first option, while the third one will be taken as the collectivist benchmark in the comparative analysis. The second option, found for example in the French system, will not be taken into consideration since it is considered to induce incumbent members to shut down operations upon quitting the firm in order to appropriate its reserves.

3. For the sake of simplicity, the terms (worker) cooperative and LMF (labor-managed firm) will be used interchangeably, although the former term is more commonly found in the empirical literature, while the latter is more widespread in the theoretical literature.

4. As is well known, the two authors referred to the former Yugoslav system. See also Pejovich (1990) and Furubotn (1976, 1978, 1980a, 1980b). Among other papers that address the problem of undercapitalization in LMFs from a theoretical point of

view, those by Zafiris (1982) and Bonin (1985) are worth mentioning. Jossa and Cuomo (1997) give a comprehensive and detailed exposition of the theoretical aspects, while Tortia (2003) surveys the related literature, as does Dow (2003), who advocates the introduction of a market for membership rights.

5. Collective reserves of capital in the former Yugoslav system were completely socialized and not appropriable by worker-members at any time. Furthermore, cooperatives were forced to maintain the book value of their capital stock, i.e., they were subjected to a strict form of capital maintenance requirement. This study retains a definition of collective reserves not distributable to worker-members during the lifespan of the firm and also upon liquidation. The justification for this restrictive rule is that collective reserves are thought to be accumulated also by the terminated generations of workers. Their distribution, either during the life of the organization or upon liquidation, would represent a not-granted intergenerational transfer of funds from terminated to incumbent members and would create a strong incentive for incumbent members to liquidate the firm in order not to bequeath the value of cumulated collective capital. The main institutional benchmark is Western cooperatives, especially the Italian and the Mondragon systems, which indeed exclude appropriation by worker-members at any point in time, though the capital maintenance requirement is looser than in Yugoslavia.

6. Various solutions to the problem of undercapitalization have been proposed. I will cite only some of them. While some authors have sought to show that the problem is not as severe as it appears in the basic model (Stephen, 1980; Zafiris, 1982; Bonin, 1985; Horvat, 1986a, 1986b; Jossa & Cuomo, 1997), others have attempted to devise alternative financial instruments (McCain, 1977; Vanek, 1977; Conte, Smith, & Ye, 1992; Smith & Waldmann, 1999; Mazzoli & Negrini, 2001; Albanese, 2003) or institutional arrangements (Vanek, 1975, 1996; Berman & Berman, 1978; Meade, 1980, 1995; Dow, 1996; Ellerman, 1990; Thomas, 1990) which could be viable solutions for the horizon problem. The intent of many of these articles is to devise financial instruments that would enable LMFs to gather additional financial resources from the market, over and above the resources deriving from self-financing, which are considered insufficient. The most thorough study in this field is the one by Major (1996), who proposes the introduction of renewable shares (NOVARRS) with two purposes: enable founding members to recoup the future value of their investments in the firm through the market value of their shares; and improve the possibilities of LMFs to gather financial resources from the market through the sale of shares. Although I acknowledge the inherent interest of this proposal, my study will concentrate on self-finance exclusively. Proposals like Major's require a more or less pronounced separation of residual control and appropriation of the residual. By contrast, this work retains a strict coupling of the two rights, as defined by Hansmann (1988, 1996) and other authors belonging to the property rights school.

7. Shares representing the value of the membership position in the firm can be sold in the market for membership rights by quitting members to incoming members. The market value of the shares is thought to mirror the present value of future returns on the membership position.

8. It is difficult to evaluate the significance of the market for membership shares present in the US plywood cooperatives. This market may relax the horizon problem



since membership positions are saleable. However, the imperfections displayed by this kind of market and its thinness (Major, 1996) may do little to solve the problem. Membership positions in the US plywood companies were reportedly sold at well below their market value.

9. No estimates of cost curves and production functions were given in this case.

10. Finally, some factors that may limit the robustness of empirical tests should be highlighted. For example, the tax system may cause distortions. If current labor income is taxed, but reinvested profits are not, the optimal choice of investments will shift in favor of future consumption, and the Furubotn–Pejovich effect may be hidden even when it is present (Horvat, 1986a, pp. 25–26). If the central authorities control the credit market and administratively fix the interest rate on loans below the free market rate, firms will tend to overuse the credit market, all the more so in the presence of limited liability and soft budget constraints (Kornai, 1986, Buck & Wright, 1990). In these cases, LMFs may even turn out to be overcapitalized.

11. A second explanation of the ability of cooperatives in Mondragon and in other regional cooperative systems, such as in Trentino-Alto Adige, to increase capital intensity is the support offered by a dedicated banking system, the *Caja Laboral Popular* in Mondragon, and the *Casse Rurali* in Trentino-Alto Adige. Such cooperative banks gather money from the public and inject it back into the system in order to serve cooperative objectives (Piersante & Stefani, 2006). Though this explanation deserves attention, it is likely to be complementary and not to substitute the mechanisms proposed in this work. The importance of better mechanisms of internal finance is likely to be reinforced and not weakened by the availability of adequate support from the banking system.

12. If we return to Eq. (2) in Section 2 and use the same symbols, we can see that individual reserves evade the problem of the temporal horizon. Since they need to be reimbursed at some point in time, they can be likened to loans. If we consider the present value of 1 Euro invested in a bank deposit:

$$PV_{BA} = i \sum_{t=1}^T (1+i)^{-t} + (1+i)^{-T} = 1 \quad (3)$$

we find that the sum is equal to 1 whatever the values of  $T$  and  $i$ . In fact Eq. (3) is an identity, not an equilibrium condition. The present value of 1 Euro deposited in a bank account, yielding an interest of  $i$  for  $T$  periods of time and withdrawn at time  $T$  is 1.

13. The residual is what is left at the end of the period, and corresponds to the profit in CMFs. Meade (1980, pp. 89–93) distinguishes between “residual” and “net residual.” The *residual* is equal to *total net labor earnings*, the value-added of the firm less the cost of capital. *Net residual* is the value-added less the cost of capital less current labor income (a variable that roughly corresponds to wages in CMFs).

14. For a detailed and interesting discussion of the interplay and possible causal links between residual rights of control and residual rights of appropriation see Dow (2003).

15. According to Hansmann (1988): “In theory, the right to control and to residual earnings could be held by different persons. In practice, however, they are generally joined, since those with control would otherwise have little incentive to use their control to maximize the residual earnings. To be sure, if all aspects of control could be contracted for ex-ante, then this problem would not arise. But control can usually be thought of as authority over precisely those aspects of firm policy that, because of high transaction costs or bounded rationality, cannot be specified ex-ante in a contract, but rather must be left to the discretion of those to whom the authority is granted.”

16. Of course, ex-ante decisions may influence the partition between current labor remuneration and the net-residual, thus conditioning investment decisions. If a lower level of investments is required, members may be confidently paid at a higher level of current remuneration during the accounting period.

17. In this respect, the need to impose mandatory reinvestment on the entire membership is supported not only by a wide array of experimental results in the field of public goods finance (Fehr & Gächter, 2000; Fehr & Schmidt, 2001), but also by the neoclassical theory of public goods and club goods (Cornes & Sandler, 1986). If there is no constraint on individual behavior, the financing of public goods gives rise to severe free-riding phenomena because of non-excludability. The imposition of mandatory contributions and of a system of punishments (fines) for deviant behavior produces completely different results: contributions become high.

18. The same result could be achieved by increasing the interest rate on individual shares up to the market clearing level without imposing mandatory reinvestment. However, this second solution presents problems linked to financial viability, and to the persistence of the non-excludability of returns.

19. Financial instruments representing a form of equity capital suitable for LMFs and different from equity in capitalist firms were proposed by Ellerman (1990) and by Thomas (1990).

20. Because the accumulation of net residuals is a type of equity capital, it may enable LMFs to avoid the problems linked with the dilemma of the collateral (Vanek, 1970), the law of increasing risk (McCain, 1977), and the lack of equity (Gui, 1985).

21. For example, individual capital shares are termed *capitale sociale* in the Italian cooperative tradition. They are reimbursed to quitting members within six months from approval of the budget following the member's departure. Italian Civil Law (Art. No. 2511) defines cooperatives as “mutualistic variable capital companies” as opposed to capitalistic firms (*società di capitali*), which are “fixed capital companies.” Under this proposal, individual stakes can be sold and do not have to be reimbursed immediately. In the first meaning, capital is not variable. However, when the worker quits the organization his/her capital stake is converted from equity into debt. In the second meaning equity capital is still variable. This is the reason why the label “variable capital companies” can be retained. In the Italian system, individual shares of capital are usually tiny. As a consequence, capital variability does not cause major problems due to their reimbursement.

22. Or at least this was the case up until the 2001 Laws No. 142 and 366 on worker-members in cooperatives. The law introduced new ways to accumulate individual capital shares, for example by giving the right to cooperatives to transform individually appropriated end-of-the year parts of net residuals (*ristorni*) into

individual capital accounts. No data are available to date on the diffusion of these innovative forms of distribution and capitalization.

23. Collective reserves are a crucial component of an LMFs capital structure, and they will continue to be so in the future, even if their role will become less all-embracing, and more room for individual accounts will be required. Collective reserves are the collective element in the financial structure of a firm, and they are not subject to the frictions due to strategic behavior linked to capital variability. They may cushion individual members against individual losses and represent the financial resource of last resort needed in periods of economic crisis, so that the firm can survive when individual members are unable to support it. All the other components of an LMFs capital structure may undergo changes more or less dangerous to its financial stability. A minimum level of collective reserves may therefore be necessary. On the other hand, in order to dampen the Furubotn–Pejovich effect, and so as not to reduce the members' financial involvement excessively, their amount is likely to need an upper bound as well.

24. Both the timing and size of contributions from individual members to the firm as a whole could be fully voluntary if the interest rate were set at a level where the aggregate contribution equals the firm's demand for funds. However, as already stated in Note 19, this solution may violate financial sustainability and contrast with the non-excludability of returns. Significantly, both Italian law and the regulation of Mondragon cooperatives forbid reimbursement during the members' period of stay in the firm.

25. It would be possible to envision bonds whose economic risk is borne by the organization: members would have entitlement to reimbursement of their capital share at face value, and the organization could issue bonds in order to pay workers their credits. In principle this is a viable solution as well. However, it has some shortcomings. If the risk is borne by the organization, members may quit when negative economic results are envisaged, asking for reimbursement at face value in the presence of a low market price for bonds, thereby aggravating the crisis. On the other hand, LMFs cannot lay off members in most cases. Hence they cannot behave in morally hazardous ways, for example by laying off members when the price of bonds is high, and retaining them when it is low. Moreover, in the absence of constraints on layoffs, this mechanism might trigger perverse consequences because LMFs would be induced to lay off members when the economic prospects are good (and bond prices are high) and to retain them when prospects are bad (and bond prices are low).

26. In Italy, the 1992 Law (No. 59) introduced financial members, a solution that was imported from the French system. Financial members have a position similar to the one of quitted members in the system here described. In the Italian environment they enjoy a minority share of votes in the control of the organization. However, it must be said that their diffusion has been limited to date.

27. Restitution of capital shares is allowed in capitalistic firms, while cooperative legislation often precludes it. For example, the Italian legislation on cooperatives forbade it until a few years ago. Under new legislation (Corporate Law, No. 366, 2001) individual members may not ask for partial restitution, but it is not forbidden to reduce the total amount of capital held individually by the workforce as a whole.

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## REFERENCES

- Albanese, M. (2003). Le difficoltà di finanziamento delle labor managed firms e il razionamento del credito. *Economia Politica*, 20(3), 303–333.
- Bartlett, W., Cable, J., Estrin, S., Jones, D. C., & Smith, S. C. (1992). Labor-managed co-operatives and private firms in north-central Italy: An empirical comparison. *Industrial and Labor Relations Review*, 46(1), 103–118.
- Ben-Ner, A. (1988). Comparative empirical observations on worker-owned and capitalist firms. *International Journal of Industrial Organization*, 6(March), 7–31.
- Berman, K. V., & Berman, M. D. (1978). The long run analysis of the labor-managed firm: Comment. *The American Economic Review*, 78(4), 701–705.
- Berman, K. V., & Berman, M. D. (1989). An empirical test of the theory of labor-managed firms. *Journal of Comparative Economics*, 13(2), 281–300.
- Bonin, J. P. (1985). Labor management and capital maintenance: Investment decisions in the socialist labor-managed firm. *Advances in the Economic Analysis of Participatory and Labor-managed Firms*, 1(1), 55–69.
- Buck, T., & Wright, M. (1990). Control in vertical hierarchies, soft budgets, and employee buy-out. *Economic Analysis and Workers' Management*, 24(4), 377–393.
- Conte, M. A., Smith, S. C., & Ye, M. (1992). Optimal internal investment in a labor-managed firm with heterogeneous membership: An overlapping generations approach. *Journal of Comparative Economics*, 16(2), 479–493.
- Cornes, R., & Sandler, T. (1986). *The theory of externalities, public goods, and club goods*. Cambridge: Cambridge University Press.
- Cuomo, G. (2004). Il finanziamento esterno delle imprese gestite dai lavoratori. In: B. Jossa (Ed.), *Il Futuro del Capitalismo* (pp. 123–147). Bologna: Il Mulino.
- Dow, G. K. (1996). Replicating walrasian equilibria using markets for membership in labor-managed firms. *Economic Design*, 2(2), 147–162.
- Dow, G. K. (2003). *Governing the firm: Workers' control in theory and practice*. Cambridge: Cambridge University Press.
- Ellerman, D. (1990). *The democratic worker-owned firm: A new model for the East and the West*. Boston, MA: Unwin Hyman.
- Fehr, E., & Gächter, S. (2000). Fairness and retaliation: The economics of reciprocity. *Journal of Economic Perspectives*, 14(3), 159–181.
- Fehr, E., & Schmidt, K. (2001). Theories of fairness and reciprocity: Evidence and economic applications. Working paper no. 75. Institute for Empirical Research in Economics, University of Zurich.

- Furubotn, E. G. (1976). The long-run analysis of the labor-managed firm: An alternative interpretation. *The American Economic Review*, 66(1), 104–123.
- Furubotn, E. G. (1978). The long-run analysis of the labor-managed firm: Reply. *The American Economic Review*, 68(4), 706–709.
- Furubotn, E. G. (1980a). The socialist labor-managed firm and bank-financed investments: Some theoretical issues. *Journal of Comparative Economics*, 4(2), 184–191.
- Furubotn, E. G. (1980). Bank credit and the labor-managed firm: Reply. *The American Economic Review*, 70(4), 800–804.
- Furubotn, E. G., & Pejovich, S. (1970). Property rights and the behaviour of the firm in socialist state: The example of Yugoslavia. *Zeitschrift für Nationalökonomie*, 30(5), 431–454.
- Gui, B. (1985). Limit to external financing: A model and an application to labor-managed firms. In: D. C. Jones & J. Svejnar (Eds), *Advances in the economic analysis of participatory and labor-managed firms*, (Vol. 1, pp. 107–120). London: JAI Press Inc.
- Hansmann, H. (1988). Ownership of the firm. *Journal of Law, Economics and Organization*, 4(2), 267–304.
- Hansmann, H. (1996). *The ownership of the enterprise*. Harvard: Harvard University Press.
- Horvat, B. (1984). Work and power: The prospects for the disalienation of work. *Economic Analysis and Workers' Management*, 17(4), 365–369.
- Horvat, B. (1986a). Farewell to the Illyrian firm. *Economic Analysis and Workers' Management*, 20(1), 23–29.
- Horvat, B. (1986b). The theory of the worker managed firm revisited. *Journal of Comparative Economics*, 10(1), 9–25.
- Hume, D. (2002 [1740]). *A treatise of human nature*. Oxford: Oxford University Press.
- Jossa, B., & Cuomo, G. (1997). *The economic theory of socialism and the labor-managed firm*. Cheltenham-Brookfield: Edward Elgar Publishers.
- Keen, S. (2002). *Debunking economics: The naked emperor of the social sciences*. Annandale: Pluto Press.
- Kornai, J. (1986). The soft budget constraint. *Kyklos*, 39(1), 3–30.
- Leibenstein, H. (1966). X-efficiency. *The American Economic Review*, 56(3), 392–415.
- Major, G. (1996). Solving the underinvestment and degeneration problems of workers' co-operatives: Non-voting and vote-weighted value added residual sharing renewable shares (NOVARRS and VOVARRS). *Annals of Public and Co-operative Economics*, 67(4), 545–601.
- Mazzoli, E. (2005). Gli sviluppi della cooperazione italiana dal dopoguerra ad oggi ripercorsi da un protagonista. In: E. Mazzoli & S. Zamagni (Eds), *Verso una Nuova Teoria della Cooperazione* (pp. 57–96). Bologna: Il Mulino.
- Mazzoli, M., & Negrini, R. (2001). Incentive-compatible financial instruments for co-operative firms: A few policy considerations. *Rivista Internazionale di Scienze Sociali*, 109(2), 137–154.
- McCain, R. A. (1977). On the optimum financial environment for worker cooperatives. *Zeitschrift für Nationalökonomie*, 37(3–4), 355–384.
- Meade, J. E. (1972). The theory of labor-managed firms and profit-sharing. *Economic Journal*, 82(March, Supplement), 402–428.
- Meade, J. E. (1980). Labor co-operatives, participation and value-added sharing. In: A. Clayre (Ed.), *The political economy of co-operation and participation: A third sector* (pp. 88–108). Oxford: Oxford University Press.

- Meade, J. E. (1995). *Full employment regained: An Agathotopian dream*. Cambridge: Cambridge University Press.
- Milanovic, B. (1983). The investment behaviour of the labor-managed firm: A property rights approach. *Economic Analysis and Workers' Management*, 18(2), 327–338.
- Pejovich, S. (1990). *The economics of property rights: Toward a theory of comparative systems*. Dordrecht, The Netherlands: Kluwer Academic Publishers.
- Piersante, F., & Stefani, M. L. (2006). Le imprese cooperative in Trentino-Alto Adige: un confronto con le società for-profit. Bank of Italy, Trento Branch, Trento.
- Podivinsky, J. M., & Stewart, G. (2006). Why is labour-managed firm entry so rare? An analysis of UK manufacturing data. *Journal of Economic Behavior and Organization*, 56(2), 239–262.
- Putterman, L. (1988). The firm as association versus the firm as commodity: Efficiency, rights and ownership. *Economics and Philosophy*, 4, 243–266.
- Seabright, P. (2006). The evolution of fairness norms: An essay on Ken Binmore's natural justice. *Politics, Philosophy & Economics*, 5(1), 33–50.
- Smith, S. C., & Waldmann, R. J. (1999). Investment and supply effects of industry indexed bonds: The labor managed firm. *Economic Systems*, 23(3), 245–267.
- Stephen, F. H. (1980). Bank credit and the labor-managed firm: Comment. *The American Economic Review*, 70(4), 796–799.
- Thomas, A. (1990). Financing worker co-operatives in EC countries. *Annals of Public and Cooperative Economics*, 61, 175–211.
- Thomas, H., & Logan, C. (1982). *Mondragon: An economic analysis*. London: Allen & Unwin.
- Tortia, E. C. (2002). L'accumulazione di capitale nelle imprese controllate dai lavoratori ed il problema delle riserve divisibili: Risvolti teorici e studi sul campo nella provincia di Ferrara. *Rivista della cooperazione*, 2, 132–145.
- Tortia, E. C. (2003). Property rights, distribution of value added, and accumulation of capital in labor-managed firms. *Economia Politica*, 20(2), 251–286.
- Vanek, J. (1970). *The general theory of labor managed market economies*. Ithaca, NY: Cornell University Press.
- Vanek, J. (1975). The basic theory of financing of participatory firms. In: J. Vanek (Ed.), *Self-management: Economic liberation of man* (pp. 445–455). Ithaca, NY: Cornell University press.
- Vanek, J. (1977). *The labor-managed economy: Essays*. Ithaca, NY: Cornell University Press.
- Vanek, J. (1996). Some fundamental considerations on financing and the form of ownership under labor-management. In: D. L. Prychitko & J. Vanek (Eds), *Producer co-operatives and labor managed systems* (pp. 125–138). Cheltenham: Edward Elgar Publishers.
- Ward, B. (1958). The firm in Illyria: Market syndicalism. *The American Economic Review*, 48(September), 566–589.
- Zafiris, N. (1982). Appropriability rules, capital maintenance, and the efficiency of cooperative investment. *Journal of Comparative Economic*, 6(1), 55–74.
- Zevi, A. (2003). Il fenomeno cooperativo e le modifiche in corso nell'ordinamento italiano. In: V. Buonocore & B. Jossa (Eds), *Organizzazioni economiche non capitalistiche* (pp. 125–148). Bologna: Il Mulino.
- Zevi, A. (2005). Il finanziamento delle cooperative. In: E. Mazzoli & S. Zamagni (Eds), *Verso una Nuova Teoria della Cooperazione* (pp. 293–332). Bologna: Il Mulino.

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**PART III:**  
**GLOBAL PERSPECTIVE**



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# THE IMPACT OF GLOBALISATION AND RELOCATION STRATEGIES IN LARGE COOPERATIVES: THE CASE OF THE MONDRAGÓN COOPERATIVE FAGOR ELECTRODOMÉSTICOS S. COOP<sup>☆</sup>

Anjel Errasti and Antton Mendizabal

## ABSTRACT

*This paper deals with globalisation and the productive relocation of co-operative firms. The relocation phenomenon is defined, and its dimensions, causes and consequences in the context of globalisation are analysed. A case study of the international expansion of Fagor Electrodomésticos S. Coop. is presented next. During the last decade, Fagor, a member of MCC, pursued a strategy of international growth that transformed it from the local cooperative into a multinational group of firms with many affiliated companies abroad. We examine the business, economic, social and cooperative implications of this strategy. The paper concludes with a*

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*suggestion of strategies for the cooperative multinational firms in dealing with the challenge of globalisation and relocation, while maintaining their cooperative identity.*

## 1. INTRODUCTION

The widespread business internationalisation process is one of the pillars of the accumulation that characterises modern-day globalisation. The exploitation of the differences in salaries and working conditions in different areas of the world economy has once again become a condition for business accumulation, particularly in the most dynamic sectors. Business internationalisation processes, which were previously the sole prerogative of large, multinational companies, are now a common occurrence in both large and medium-size companies based in industrialised countries, which are currently striving to overcome the uncertainties that cast a shadow over their future survival.

Nowadays, the globalisation of competition, combined with information and communication technologies, enables companies to outsource and externalise production processes, thereby generating conditions that are more conducive to a flexible workforce and the dismantlement of the social clauses guaranteed by collective bargaining and social laws of the previous era. Under such conditions, 'business relocation' processes become a key element in an economic and social attack on employment and workers' rights. The relocation of production activities provides a channel for exploiting the differences in salaries and social-labour conditions of a workforce that has become an international reserve army. In our industrialised societies, this particularly affects less-qualified workers, who are the first victims of relocation and who end up in a socially disadvantaged position.

Over the past few years, many cooperatives have become involved in a deep-rooted process of internationalisation, which has brought with it the transformation of cooperative experiences into multinational businesses with a nucleus that maintains their cooperative nature and a periphery made up of multiple production centres, subsidiaries, within a framework of capitalist relationships (Clamp, 2000; Errasti, Heras, Bakaikoa, & Elgoibar, 2003). One significant example is the case of Mondragón Cooperative Corporation (MCC), which is a point of reference for participatory enterprises all over the world. During the last decade, MCC's cooperatives have been

adapting to the global market conditions and pursuing a strategy of direct investment (joint ventures, greenfield investment and takeovers), mainly in the so-called emerging markets. Nowadays, MCC is formed by 120 cooperatives, structured into four groups – industrial, financial, distribution and research & training – employs more than 70,000 people and recorded a turnover in 2005 of over 8,000 million euros. The main nucleus of businesses within the industrial group is made up of a number of multinational cooperative holdings with more than 40 foreign subsidiaries. According to the MCC internationalisation plan, in the year 2008 there will be 55 foreign subsidiaries, external production of the MCC industrial group abroad will account for some 19% of the total (translating into 1,260 million euros, of a total turnover of 6.632), and the industrial workforce will be 12,000 persons, of a total of 40,000 industrial employees (MCC, 2006).

We have discussed this internationalisation process of the Mondragón Cooperatives in previous works. In Errasti et al. (2003), we give a general overview of the process and point out some contradictions between the basic objectives of a business organisation competing in international markets and the historical core principles and values of the Mondragón cooperatives; in Bakaikoa, Errasti, and Begiristain (2004), we analyse the governing structure of the MCC corporation and the different types of employment generated within the context of the expanding globalisation process.

This chapter deals with the issue of productive relocation of cooperative firms from a theoretical and empirical point of view. In the first part of the paper the relocation phenomenon is defined and its dimensions, causes and consequences are analysed. The second part of the paper presents a case study of the international expansion and relocation strategy of the Mondragón cooperative *Fagor Electrodomésticos S. Coop.* During the last decade, Fagor pursued a strategy of international growth that transformed the original local cooperative into a multinational group with many affiliated companies in countries like Morocco, Argentina, Poland, China and France. The case of Fagor clearly illustrates the problems many large industrial cooperatives have to face in order to be competitive in highly concentrated and internationalised markets. The paper examines the tension provoked by two of the goals of an internationally expanded cooperative competing in a global market and, therefore, facing relocation: firstly, job creation and the generation of wealth, affecting the local community, and secondly, participation and democratic control. In conclusion, the paper proposes some strategies for dealing with the challenge of globalisation and relocation that also enable cooperative firms to preserve their cooperative nature.

## 2. THEORETICAL FRAMEWORK: RELOCATION IN THE CONTEXT OF GLOBAL CAPITALISM

### *2.1. Different Perspectives of the Relocation Problem*

In general terms, relocation refers to the international displacement of production activities and is a major cause of unemployment in countries of relocating firm's origin. From a business perspective, the aim is to enhance profitability levels by selling products in new markets, acquiring supplies from the most suitable sources and concentrating production activities where costs are lowest. It is currently a fashionable concept in Europe, where German and French companies have threatened to relocate production activities to other areas if workers refuse to increase their productivity levels, accept lower salaries and increase their number of working hours (Mendizabal, Zurbano, Sarasua, & Udaondo, 2005).

At first glance, relocation processes seem to adopt a classic North–South pattern, and reflect the way in which companies in industrialised countries become involved in the industrialisation processes of developing countries with much lower labour costs (Baron, 2004). Some authors believe that relocation should be understood as the simultaneous process of eliminating jobs in one country and creating them in another, in order to manufacture the same products and sell them on the same markets. Others highlight the existence of relocation processes that aim to establish production branches targeted at new, emerging markets. Authors such as Lipietz (2004), for example, base their theories on this distinction in order to differentiate between positive and negative types of relocation. In their judgement, production relocation processes originating in Central Europe are legitimate (positive) in that they respect the expansion of the market. French companies, which set up companies in Poland for the Polish market create jobs in France: design work, study offices, specialist manufacturing, etc. However, if they move production to Poland in order to then export back to France, they sow nothing but disaster: over-exploitation in Poland and employment regulations and redundancies in France and Germany, not to mention bottlenecks and increased pollution (Lipietz, 2004).

Opinions also differ concerning the importance of relocation. According to the business world, this phenomenon is at the heart of world social-productive dynamics, and will force all involved to undergo drastic changes. According to this view, relocation is a basic trend that represents necessary restructuring of industrialised economies. Some data specify that 104

companies from the fifteen countries of the old European Union offshored their activities between 2002 and 2003 (Borja, 2006).

Between 1990 and 1995, 174 cases of relocation were recorded in the European Union. Based on Bundesbank reports (2004), Professor Salva Torres found that up until the year 2000, German companies had generated over 2.4 million jobs outside the country, while domestic industrial employment had decreased by 2.3 million jobs. Levis, the world leader in the jean manufacturing industry, has closed all its factories in the United States and Canada, and has transferred production to other countries. Cross-border assembly plants in Mexico have also been affected by the large-scale relocation of North American companies in the car, electronics and consumer goods industries (Torres, 2004).

Other analysts believe that relocation is a marginal phenomenon, which has a limited effect on industrial activity and employment. A report on relocation drafted for the French Senate Commission and published in July 2004 states that the process is not yet a statistically significant phenomenon and that its effects on countries' industrial capacity and employment is extremely limited (Commission des Affaires Économiques du Sénat, 2004). A number of different reports published by the European Commission, the International Monetary Fund and other international bodies express the same opinion. It is important to bear in mind that the statistics, which refer to both relocation and the outsourcing movements on which they are based, are still very inconclusive (Mendizabal et al., 2005).

## *2.2. The New International Division of Labour*

Relocation is nothing new. It is an economic phenomenon, a product of the internationalisation of capital and markets and the international division of labour brought about during the 20th century by just over 200 transnational groups that dominated the international market.

A brief historical perspective may shed some light on the scope and significance of this process. Primarily, relocation is a structural component of multinationals that squeeze royalties out of their subsidiaries and repatriate profit back to the parent company. However, it is the so-called 'new international division of labour' from the middle and end of the 1970s which established the global nature of these processes, internationalising the social and technical relations that characterise the Ford-ist production process, and multiplying transport and logistic requirements for what is essentially

the same production process. This international division of labour places qualified workers for products with high added value at the centre, while making use of low costs and less-qualified labour forces on the periphery (Mendizabal, 1998).

In this sense, we could mention the large-scale production relocation process that, during the second half of the 1970s, transferred labour-intensive production activities (those in which labour cost is a key factor in the composition of added value) to the developing world, where salary levels were much lower. This had a direct effect on traditional industries, such as the iron and steel, shipbuilding, semiconductors, electronic products and textile industries, resulting in the decline of long-standing industrial regions in industrialised countries.

As a result of this process, during the 1980s we witnessed the rise of four Asian giants: Singapore, Hong Kong, South Korea and Taiwan. All were small economies open to the rest of the world that managed, thanks to a policy of low salaries, education, and heavy state investment, to attract a large percentage of outsourcing activities from the industrialised world. This industrialisation model later spread, to produce the 'new industrialised countries', in other areas such as Malaysia, Indonesia, Thailand, the Philippines, Mexico and Brazil, among others. The evolution of this international division of labour may have lead us to conclude that the trend would later intensify, transferring the main bulk of the workforce away from central countries. However, its subsequent evolution chose a different path.

### *2.3. Relocation and Globalisation*

Economic liberalisation processes set in motion during the 1990s made it easier to enter the various markets and sectors of the world economy. The increased competitive pressure generated by this process of globalisation resulted in company cost cutting and a large-scale social-organisational revolution in production processes in industrialised countries. A series of fundamental changes occurred. Firstly, the classic formulas for relocation expanded increasingly towards multilocalisation. In other words, companies established various offshored plants in a number of different places, depending on the differences in added value and the technological complexity of the production activities to be carried out.<sup>1</sup> The companies that use multilocalisation are those that find it easiest to transfer their activities to other locations. It is also a frequent strategy in dynamic companies, which channel their business internationalisation towards both emerging and

mature markets.<sup>2</sup> Secondly, relocation has now spread to all areas of activity, encompassing even those that require highly qualified staff and state-of-the-art technology. In other words, the process increasingly affects both the labour-intensive activities with low value added, and technology-intensive activities with high value added, such as the automobile, aeronautic and computer industries.

Thirdly, new technologies have increased the range of outsourced activities, with this field now encompassing all business functions. In this way, relocation tends to expand towards service areas, using information and communication technologies to enable transfer of administrative processes to other countries. This is the case of the *call centres* and computer application and processing sections set up by telephone companies, computer banking systems and airlines, for example. New technologies enable administrative services to be carried out in places other than the parent company (using data transmission resources), outsourced to other companies in the country, or simply offshored.

All this gives us a better understanding of current situation in the world economy, in which the majority of international investment is transferred between industrialised countries. The new situation reflects the absolute dominance of the more industrialised countries and a part of Asia in world market transactions. Available data show that, in the year 2000, the developed world accounted for 91% of capital outflow and 79% of inflow, with an evolution strongly marked by mergers and takeovers. These data also indicate an increasing gap between salary costs and relocation (Mendizabal et al., 2005).

Indeed, if salary costs were the determining factor in business establishment strategies, then we would be hard pressed to explain why the least-developed countries attract the lowest proportion of international investment. It is worth mentioning that today, France is the fourth most important beneficiary of direct foreign investment in the world, and investments by European Union countries in Switzerland is twice as high as their investments in the African Continent.

Table 1 shows the destination of direct foreign investment from the European Union. We can see that the United States receives 59.8% of the total, and if we look at the European countries the figure totals 74% (Centre Confédéral d'Etudes Économiques et Sociales, 2003).

However, the most interesting thing to note is that countries described as 'developing' are able to guarantee qualified production activities with the help of a competent labour force. This fact contradicts the international trade theories based on the comparative advantage, according to which



**Table 1.** European Union Investment in the Rest of the World (as a % of the Total).

	1990–1995	1995–1999
Accumulated total during the period <sup>a</sup>	111,694	589,697
North America	48.4	60.7
United States	47.2	59.8
Central America	6	3.8
South America	6.5	13.3
Africa	2.2	1.9
Asia	9.8	5.5
Oceania (including Australia)	3.1	0.8
Other European countries (not EU or EFTA)	14.7	7.7
Including EU accession countries	13.1	6
EFTA	8.4	6.2
Including Switzerland	5.8	4.4

Source: Report on the state of the European Union (2002).

<sup>a</sup>In billions of dollars.

countries with an abundant workforce should manufacture products that require a low level of capital, while those in which labour is scarce should specialise in products incorporating advanced technology and a high level of capital.

Numerous examples show this trend toward transferring industries and services with a high added value to poorer countries. Indeed, the main engine production unit of the Volkswagen-Audi-Seat group is now located in Hungary. For its part, Ford's Mexican plant in Chihuahua is one of the most efficient in the world in the manufacture of highly sophisticated engines. The software parks in Bangalore (India) employ more computer engineers than California's Silicon Valley and many northern countries have a number of offshored research centres (Baron, 2004).

#### 2.4. *The Rise of China and the Expansion of Europe*

At an international level, we are witnessing the rise of the People's Republic of China, with its potential market of 1.3 billion people, which by implementing a system of unfettered capitalism in over 100 special economic and technological development zones, has created unbeatable conditions for attracting foreign investment and international outsourcing. Some of China's labour-market characteristics comprise working weeks between 60

and 100 hours, intensive use of female labour, absence of holidays and social security, complete freedom of labour contracts and dismissals policy, and salaries of around 30 euros per month. Following the entrance of the country into the World Trade Organisation (WTO), China's special zones have become a benchmark for the application of international regulations.

The People's Republic of China has managed to attract thousands of foreign multinationals, overcoming competition from other low and medium value-added product producing countries. Since the beginning of the century, China has received 75% of the foreign direct investment (FDI) targeted at developing countries, and its spectacular growth is causing price rises in steel, oil and other raw materials all over the world, and price decline in manufactured goods. In this country alone, 30 million workers, spread between 2,000 duty free zones, operate in a special tax and funding system that is characterised by the near complete absence of social and environmental controls (Borja, 2006).

For its part, the expansion of the EU in 2004 to include 10 new countries from Eastern Europe poses a number of new challenges. The combination of low salary levels, considerable technological development, a qualified workforce, and proximity to the large central-European market is particularly concerning for Southern European countries. The GDP of some of these countries totals only 30% of the EU mean, with the five new countries from Central Europe recording an average of 53%, the three Baltic States 37% and Bulgaria and Rumania just 26%.

Thus, prevailing salary levels in those countries are 10 times lower than that of Germany, for example. The risk of multinational companies using these cost differences to generate social regression in Europe as a whole is a possibility that cannot be ignored. Table 2 compares German salaries in 2002 with those in seven candidate countries during the same period. The

**Table 2.** Salary Costs in the Manufacturing Industry in Eastern European Candidate Countries (USA dollars/h).

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Germany	32
Czech Republic	3.4
Estonia	2.38
Hungary	3.38
Latvia	2.01
Lithuania	1.63
Poland	3.22
Slovakia	2.76

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*Source:* Bureau International du Travail (BIT), June (2002).

BIT compiled the data for the informal meeting of social affairs ministers from the then candidate countries.

In short, the new European accession countries are extremely attractive from an industrial point of view, offering a well-qualified labour force, costs far below those of Western European countries and geographical proximity to the large central-European market. At the same time, the trade unions affected by the problem have to renegotiate their social-labour conditions, accepting the business logic that demands salary reductions, longer working hours and a greater degree of productive flexibility in order to prevent relocation. Obviously, the co-ordination of policies that favour employment at the European level is currently an extremely pressing need.

### *2.5. Counter-Trends to Relocation*

As mentioned earlier, the majority of international investment is carried out between developed and industrialised countries. Everything indicates that the trend towards business relocation does not extend inexorably to all areas of the economy. In fact, the relocation of production activities is currently facing at least two important counter-trends that ensure the basic durability of the economies of industrialised countries (Lipietz, 2004).

The first of these counter-trends is linked to the fact that the vast majority of labour, in construction, domestic services, personal services, diverse tasks in education and health, community services, etc. 'cannot be offshored', and therefore remain in their places of origin. At the same time, there is nothing to say that the production of transportable goods, such as manufactured products, design tasks, development of new products, worker skills and qualifications, innovation work, on-line services, etc., cannot be carried out in industrialised countries. The challenge is to ensure that we carve ecological, social and cultural niches in our countries that ensure the proximity of the markets and guarantee the quality of the production centres, and therefore the products themselves. Participatory management systems, knowledge management and, particularly, communication and collective knowledge are key factors in this second counter-trend. And this is precisely the policy endorsed by countries with the highest salary levels in Europe, such as Northern Italy, Southern Germany, Scandinavia and Switzerland.

### *2.6. Relocation and Business Profitability*

Judging by the arguments put forward by the business world, the underlying reason for the relocation of production activities is the high salary levels

prevalent in industrial societies. Business managers tend to agree in their complaints about too high salaries, over-developed social rights and social protection, the excessively rigid labour market and unreasonably high capital gains taxes. The essence of this discourse is to persuade workers to accept sacrifices as a *sine qua non* condition for defending their jobs. In the case of European workers, this need has become particularly urgent and imperative in light of the expansion of the EU to include Eastern European countries.

Authors such as Michel Husson (2005a, 2005b) have criticised this line of argument. They assert instead that while it is true that Polish salaries are five times lower than the European Union mean, if all the workers in the European Union were to adjust their salaries to the Polish level, the European economy, while being no doubt competitive, would become a dead economy, because the global demand of the salaried population would have dropped to just 20%. These authors believe that even if we admit that European salary reductions will not be so spectacular and that, at most, salaries could decrease by 30%, the salary gap between Polish workers and the rest of Europe would go from 1/5 to 1/3. Obviously, this does not solve the problem of the stagnation of the European economy (Husson, 2005a, 2005b).

In light of these conditions, it is important to remember that the majority of business relocation initiatives are the result of a cost-cutting strategy that has no social justification. In other words, jobs are sacrificed in order to increase the profit margin rather than in response to any real risk to the survival of the company.<sup>3</sup> As such, it becomes evident that the assessment of relocation decisions should be an economic–environmental–social one, particularly from the cooperative perspective. This would take into consideration other aspects also such as job maintenance, the situation of the region, the increase in transport and increased pollution, etc., rather than just the economic implications of such a step, focusing solely on increasing the company's profit margins. Promoting investment in socially responsible companies, with a smaller return on investment, would be a part of this strategy.

### *2.7. Relocation Factors*

Labour costs, innovation and qualified workers are key factors in relocation. The spatial environment in which production takes place, the existence of a regulated legal framework, external technological factors, economies of scale, proximity to large markets and transport infrastructures are also decisive. The majority of the favourable environmental factors mentioned here are encompassed by the concept of 'economies of agglomeration', or in other words, economies derived from the concentration of production activities in

a specific geographical area, with a series of historically accumulated infrastructures, skills and knowledge. As a result, relocation does not entail the dismantling of production processes in industrialised countries. Too many economic, social, political, cultural, technological, environmental, historical and linguistic factors influence the evolution of developed societies.

In practical terms, the primary factor in relocation has always been the salary/productivity ratio. In other words, it is not enough simply for the salary of a worker in Thailand to be 16 times lower than that of a worker in France, or for that of a Malagasy worker to be 36 times lower. What really matters is the salary cost per unit produced, which is tantamount to including the technological level of the products or production processes in the equation.

A second factor is proximity to emerging or mature markets, a consideration that condemns or at least limits many African and Latin American regions. Another relocation factor is the increasing qualification levels of the workforce, which is not restricted exclusively to the developed world, but is rather gradually expanding to include some developing countries also. Thus, Thai workers are becoming highly specialised in textile production, the manufacturing of computer parts and the handling of plastic materials, for example [Bonnet \(2001\)](#).

A fourth factor in relocation decisions is the flexibility of the workforce in the target country. Longer working hours, 6–7 day workweeks, and flexible social laws grant companies almost absolute power over their employees. We should also take into account the highly favourable tax policies established with the aim of attracting investment, as well as the complete absence of environmental regulations in many of these countries [Bonnet \(2001\)](#).

In the same way, the location in which production activities take place is crucial for ensuring efficiency and competitiveness. This concept includes being able to purchase components and obtain diverse supplies, as well as having the technological and innovation structures available in the local area. Another factor influencing relocation decisions are lower transport costs and the ease with which goods can be imported and exported. This in turn is directly related to the road and rail networks, the management of the main ports and the existence of suitable, strategically located international airports ([Centre Confédéral d'Etudes Économiques et Sociales, 2003](#)). In general, relocation needs to give rise to a sharp increase in competitiveness that increases the profit margin, thereby enabling companies to engage in future investments.

To date, relocation has not affected the growth of industrialised, capitalist economies, and it is not likely to in the future ([Mendizabal, Zurbano, Sarasua, & Udaondo, 2005](#)). Nevertheless, it is likely that it will cause

production activities in the developed world to become increasingly intensive in technology, research, innovation, social organisation and qualified labour. The threats posed by relocation do not just emanate from technologically lagging countries, but also from more advanced economies that offer a better-qualified workforce, technology, innovation, better social organisation and greater economies of agglomeration.

### *2.8. Territoriality Factors*

When taking into account cooperative firms, we should also consider territoriality factors. Such factors refer primarily to company ownership and history. Thus, shared ownership of the share capital by the member-workers of cooperative companies is a powerful factor for firmly rooting the company in its social and territorial context. Similarly, practical experience suggests that foreign-owned companies are more prone to relocation than those who operate with domestic capital (Myro & Fernández-Otheo, 2004).

Foreign-owned companies, and in particular, those that endorse a multilocalisation strategy, tend to be both well qualified and internationalised, as well as quicker to adjust to changing demands by transferring production from one subsidiary to another. The longer the time the company has been operational in a specific country, the closer the relationship between the activities of the host country and those of the parent company. Whether or not major shareholders are also the founders of the company, or have simply acquired the majority of shares, is also extremely important.

Secondly, we should consider factors that are linked to the company's intangible capital, as well as those related to its location in a specific environment. Participatory management systems, knowledge management systems, the existence of a high proportion of qualified staff, business innovation systems, collective knowledge and the degree to which the company is integrated into the social and cultural context are also decisive factors for maintaining a sense of territoriality.

Thirdly, we believe that it is precisely the factors most conducive to relocation that also ensure territoriality. In this sense we should highlight once again the 'economies of agglomeration', the existence of technology and innovation centres; SME environments that ensure components, supplies and qualified collaborators; the carrying out of design and subassembly integration activities which are hard to offshore; transport infrastructures; proximity to large emerging or mature markets; the integration of a training and professional qualification system; and the existence of technological, social and productive 'collective knowledge', accumulated over the historical process.

Fourthly, it is also worth remembering that factors that ensure good internal social organisation, the legal regulation of an economic, environmental and social framework, social conquests, the quality of democratic development, social cohesion and the political and cultural elements that together make up a territory's sense of identity, are the driving forces in the preservation of territoriality.

### *2.9. The Perspective of Northern Economies*

The development of industry and the tertiary sector in the developing world is a structural trend with a long-term perspective. Northern companies will participate in this process and the way in which they do so will affect everyone. A narrow-minded perspective focused solely on taking competitive advantage of low salaries with an absence of social and environmental regulations will prove disastrous for all. A European construction, for example, that aims to bring salaries and social-labour relations down to the lowest common denominator will have the same devastating effect. In this sense, the 'Bolkenstein directive', which proposes the 'principle of the country of origin'<sup>4</sup> for transport and logistics aims to legalise these practices.<sup>5</sup> The second and far more suitable option is the approach described above.

The idea is to maintain design or conception activities, the interface between the introduction of new products, and the new philosophy of production. The establishment of common knowledge and solidarity is also essential. In broad terms, the aim is to create economic, social, political, and cultural niches based on participation, democracy and solidarity, which will ensure the quality of the products manufactured and free up society's creative spirit.

## **3. THE CASE OF FAGOR ELECTRODOMÉSTICOS' EXPANSION TO INTERNATIONAL MARKETS**

### *3.1. Introduction*

*Fagor Electrodomésticos S. Coop.* is a typical case of a large cooperative firm facing issues of internationalisation and relocation in a highly globalised, concentrated and competitive sector. Fagor was the first cooperative in the 'Mondragón experience', established in 1956, and has since become the main industrial reference of *Mondragón Corporación Cooperativa* (MCC) and one of the biggest industrial cooperatives worldwide (in 2005, its workforce

includes more than 10,000 workers and its turnover amounts to nearly 1,800 million euros).<sup>6</sup> Nowadays, Fagor is a multinational company with 16 cooperative and non-cooperative production centres in Europe, Africa and Asia. The determination of the production, investments and personnel for each centre plays an important role, whether in relation to competition, industrial productivity, the technological capacity of the home or host countries, the volume and upgrading of human resources or the spreading of the cooperative culture.

Fagor is the main industrial driving force in the area around the town of Mondragón, which enjoys a high level of economic development reflected in the high number of existing industrial, financial, service, research and university cooperatives. Consequently, the region enjoys a high employment rate and one of the highest and most equitable average per capita income rates in Spain (Errasti et al., 2003); however, the narrow valleys of this region suffer from a high level of environmental damage.

The two main issues of this study are how long will Fagor remain a key creator of jobs and wealth in the Mondragón area and whether or not the cooperative model will prevail among its companies, since the group is competing on an increasingly globalised market. To answer these research questions, the case study will start by analysing Fagor within the context of the European household appliances sector. Next, we will discuss some aspects of Fagor's 'cooperative dilemma' between coop values and global pressures that makes Fagor different from the other multinationals. Finally, we will consider some strategies for overcoming these dilemmas, mainly based on innovation and cooperation.

We used participative observation and the analysis of available publications, as well as conducted interviews and meetings with managers of the cooperative, representatives of Fagor's Social Council and Governing Council and visited *Wrozamet*, Fagor's subsidiary in Poland, where we had the opportunity of meeting local managers, workers and trade-union representatives. While Fagor has been the object of various studies conducted both by external researchers and those participating in its creation and development,<sup>7</sup> the issues of its internationalisation and relocation processes has not yet been analysed.

### *3.2. Fagor in the Household Appliances Sector*

European household appliances sector is becoming increasingly more concentrated with more than 30 mergers since 1984. Table 3 illustrates this trend showing the dominance of a few multinational competitors.



**Table 3.** Household Appliances Sector in Europe: 2003 Group Ranking List.

Group	European Market Share (%)	Total Turnover <sup>a</sup>	Scale
BSH (Bosch Siemens)	19.9	6,300	6.9
Electrolux	16.8	13,600	14.9
Merloni	11.5	3,008	3.3
Whirlpool	9.7	10,207	11.2
Miele	5.6	2,190	2.4
Brandt	3.6	858	0.9
Candy	3.5	939	1.0
Fagor	2.2	911	1.0
Remaining groups	27.4		

*Source:* Fagor Electrodomésticos based on GFK data. Market share in Western Europe.

<sup>a</sup>Including Europe and other markets.

The sector is currently immersed in a restructuring process, in light of the emergence of new Asian manufacturers (especially in China, Korea, Japan and Turkey) and a concentration of distribution, with different companies forming strategic alliances in order to make joint purchases. This process has considerably reduced European manufacturers' margins, something that is especially true for the European manufacturers with the lowest sales volumes, due to their difficulties in achieving a return on investment (for example, R&D) and negotiating with distributors.

In order to remain competitive, Fagor's strategy has been focused on internal and external growth. During the national white goods firms restructuring process Fagor purchased a domestic private firm 'Fabelec', which it soon converted into a cooperative. In the 1990s, growth was mainly international with the takeover of subsidiaries in Morocco, Argentina, Poland, China and recently in France (Brandt). After purchasing Brandt, Fagor has doubled its size and now ranks fifth (rather than eighth) in the European group list, based on European market shares.

Nowadays, Fagor sales on the Spanish market constitute 35% of its total turnover, and it is the market leader with a share of 20%, followed by BSH and Electrolux. The other 65% of sales take place outside the Spanish market, mainly in the European Union. In France, the cooperative group is market leader, through the Brandt label, with a market share of 18%. In Poland, its Mastercook brand is leader in the cooking sector, while in Morocco, Fagor products are also the clear leaders with a market share of 25%.

As illustrated in Table 4, in addition to its headquarters in the Basque Country, Fagor also controls four foreign affiliates, a myriad of small

**Table 4.** Fagor Electrodomésticos in 2005.

Plants	Country/Town	Set Up or Purchase Year	Equity Participation of Fagor (Including MCC)	Workforce <sup>a</sup>	Sales <sup>b</sup>
Fagor Electrodomésticos, S. Coop.	Basque Country	1956	100% members of the cooperative	3,846	815.400
Extra Electromenager, S.A.	Morocco	1994	100%	234	28.199
Wrozamet, S.A.	Poland	1999	76%	1,448	123.125
Geysler-Gastech, S.A.	Basque Country	1998	50%	211	65.574
Brandt, S.A.	France	2001	100%	4,404	719.297
ShangaiMinidomésticos Cookware Co.	China	2003	30%	320	3.681
Foreign Commercial Subsidiaries <sup>c</sup>	–	–	–	206	186.072
New activities <sup>d</sup>	Gipuzkoa	2004	(see Table 5)	63	444
Total	–	–	–	10,732	1,941,792

Recently Closed or Sold Plants	Country	Years	Equity Participation	Workforce
Mc Lean	Argentina	1999–2003	50%	371
Fagor Fresh	Egypt	1994–1996	50%	100

Source: Fagor Electrodomésticos (2006).

<sup>a</sup>Average annual workforce.

<sup>b</sup>Million €.

<sup>c</sup>Commercial subsidiaries of Fagor Electrodomésticos in Portugal, Czech Republic, Hungary, USA, Netherlands, Germany, France, Thailand and Malaysia.

<sup>d</sup>This issue will be further discussed in Section 3.3.5.

foreign Commercial Subsidiaries and a local joint venture with one German company, Vaillant. Some of the foreign affiliates are further discussed below.

In 1999, Fagor purchased *Wrozamet, S.A.*, a Polish cooking product manufacturer (ovens and standalone cookers), in an auction conducted during the Polish privatisation process.<sup>8</sup> According to Gómez Acedo, Fagor's Managing Director at the time, the main reason for the purchase was to strengthen the group's presence in Eastern Europe. Wrozamet's Mastercook brand was very well known and would serve as: (a) an access point to the Polish market, representing 38 million people, in which Mastercook had a 50% market share and (b) a bridge to Germany, the Czech Republic, the Baltic Countries and Russia. Fagor and MCC Investment purchased 76% of the Polish company with a joint investment of 31.25 million euros. 17% of the capital still belongs to the Polish Treasury in 2005. When the government decided to privatise the company, there were around 1,700 workers in Wrozamet. Nowadays, there are only 900 workers in the Polish plant due to the drastic restructuring process conducted by Fagor, although this figure is expected to increase in the future. Recently, Fagor has invested 4.6 million euros in Wrozamet's plant in order to set up two new production lines. Wrozamet now manufactures worktops, ovens and washing machines for Eastern markets. The Polish plant also manufactures cookers and a refrigerator model for the whole of Europe (formerly manufactured in Mondragón, meaning that workers had to be relocated to other areas of the cooperative).

In 2002, Fagor participated as an active partner with 10% of the bid price for the French household appliance manufacturer *Brandt Électroménager*, the leading company of the Electra Consumers Products LTD (ELCO) group. This operation involved an investment of over 50 million euros. Both manufacturers went into partnership in order to make a joint takeover bid for the takeover of Brandt, which had been put into receivership and had 5,300 workers. In 2005, Fagor bought Elco's equity participation, the estimated cost of the operation ranging between 145 and 170 million euros (with MCC's equity participation amounting to 50 million euros). Brandt has production plants in France (Lyon, Orleans, Vendôme, Aizenay, Lesquin and La-Roche-Sur-Yon) and Italy (Verolanuova), with sales of over 800 million euros, and aims to become a leading brand in the French household appliances market with a market share of 17%. Brandt markets French brands such as Brandt, Sauter, Thompson, De Dietrich and Vedette, as well as the Italian brands San Giorgio and Ocean. By purchasing Brandt, Fagor expects to increase its dimension and the benefits obtained from

synergies achieved through the integration of subsidiary, commercial, industrial, administrative and central service structures. The main objective of the operation is the integration and rationalisation of Fagor's industrial activity and 'the new post-purchase Brandt', in order to gain competitive advantages for both parties (production, purchase, research and development). Nevertheless, it includes an element of risk. Firstly, one may wonder whether Fagor will be able to manage this new company and attain the forecast synergies. Secondly, this is a time when moving to Asian or Eastern European countries has become a clear trend, something that poses difficulties when it comes to keeping up with the current employment rate in the existing cooperative plants. As a result, Fagor will be forced to reduce dramatically Brandt's workforce in France and Italy, as we discuss below in Section 3.3.3.

There is also another subsidiary in China: *Shangai Minidomésticos Cookware Co.*, a joint venture set up thanks to a collaboration agreement between the Fagor Electrodomésticos Group and the Xiangian Stainless Steel Products Company (belonging to the Shangai Vacuum Flask Corporation). This subsidiary produces half a million pressure cookers per year for the principal markets in the world (we have not included this plant in our analysis since it is a business area not strictly related to the electrical appliance sector). Furthermore, we should highlight Fagor's intention of increasing its presence in the Chinese market through the manufacturing and sale of boilers.

We should also take into account that Fagor used to own two more foreign subsidiaries that it no longer controls. In 1996, *Fagor Fresh* was constituted with a local partner as an assembly company in Egypt to avoid customs tariffs on imports. Due to some problems with the partner, however, this initiative lasted only two years and the Egyptian market is now serviced once again by exports. From 1996 to 2003, *McLean* was chosen as Fagor's gateway into Mercosur (the economic community comprising Argentina, Brazil, Paraguay and Uruguay), but Argentina's economic recession and the continuous losses of the affiliated company prompted the sale of Fagor's Equity to its local partner (a company owned by General Electric and some private Mexican investors).

### *3.3. Cooperative Strategic Dilemmas in the Face of Relocation*

Fagor has become a multinational company in order to remain competitive. Therefore, an obvious question is what is the difference between Fagor and

its competitors in the sector, such as Electrolux, BSH, or Merloni? The main difference lies in the ownership of the company. Fagor, being a cooperative, is owned by its worker members in Mondragón and its management is based on the 'one member, one vote' rule. Shareholders own its competitors, since they are public limited companies in western European countries. In case of Electrolux, on 31 December 2004, almost 38% of the capital was owned by foreign shareholders, nearly 50% by domestic Swedish institutions and pension funds, and around 12% by private Swedish investors.<sup>9</sup>

Something that makes Fagor different if compared to other multinationals is the cooperative dilemmas it faces to compete in a growing European Union with a globalised economy. The dilemmas could be divided into: (a) dilemma for growth control: takeovers versus strategic alliances; (b) governance dilemma in a cooperative context: business interests versus member interests; (c) efficiency dilemma: local employment versus external employment; and (d) identity dilemma: cooperative identity vs. multinational corporation nature. We discuss these further below.

### *3.3.1. Dilemma for Growth Control: Takeovers versus Strategic Alliances*

Fagor faces a number of challenges in its international expansion. In particular, as a cooperative, it is constrained in its strategic possibilities. It can neither merge with other companies in the sector, nor be absorbed by any other corporation if this operation means the loss of its cooperative structure. As a cooperative company it has two possibilities to achieve external growth: takeovers and strategic alliances. The latter are rare due to both the existing rivalry in the sector and the difficulty of performing inter-firm operations (for instance, share exchanges between two firms).

However, Fagor collaborated with the French manufacturer Thomson Electromenager in the creation of the TEMFA group with the aim of improving its dimension and image among distributors. In 1992, the first English manufacturer, General Domestic Appliances (GDA), joined them and the group was renamed EURODOM. This initiative was nevertheless frustrated because Elfi purchased Thomson in 1994 and Merloni purchased GDA in 2001. In 2002, the 10% equity participation in the purchase of Elco-Brandt mitigated somewhat this situation. Later on, Fagor had to refuse Elco-Brandt's merger proposal, which was not viable due to the company's cooperative structure, and opted for the total takeover of Elco-Brandt.

It must be pointed out that financial support from the corporate resources of MCC has been very important for the international growth of Fagor. As mentioned above, the takeover of the foreign affiliates Wrozamet, Brandt and Mc Lean has been performed using both Fagor and MCC resources.

MCC controls some funds made up of contributions made by the individual cooperatives. The most important one is a financing mechanism – the Central Inter-Cooperative Fund – made up from 10% of the gross profits of each cooperative (except for Caja Laboral, with a 20% contribution). The MCC Business Promotion Investment Society, MCC Inversiones, and the MCC Foundation handle these funds. This financial tool is of vital importance for achieving the strategic objectives of growth and internationalisation of MCC cooperatives (Bakaikoa et al., 2004).<sup>10</sup>

At this point, one might wonder what would have happened had Fagor not been a cooperative. Within the sector's concentration processes, it would probably have been absorbed by a multinational corporation and would now be suffering the threat of its production being moved to a different country. However, being a cooperative, it must seek to strike a balance between globalisation imperatives (in this case acquiring other firms in order to gain the economies of scale and profitability necessary to survive), and cooperative principles and job sustainability.

### *3.3.2. Governance Dilemma in a Cooperative Context: Business Interest versus Member Interests*

Management body makeup in Fagor is based on its cooperative structure and constitutes a fundamental element that affects its business activity. Fagor's main governing body is the General Assembly, which is made up by its members and elects the Governing Council, the latter being a representative body that governs the cooperative and elects its Managing Director. Strategic decisions must be directly or indirectly supported by worker members. For instance, if the volume of a subsidiary purchase operation exceeds the limits defined in the social statutes, it must be submitted for approval of the members.

The recent purchase of Elco–Brandt, the biggest business operation ever conducted in the history of Mondragón cooperatives, was voted upon in an Extraordinary General Assembly that reflected the reactions of the social and management bodies of the cooperative when faced with new challenges. The report presented by the Social Council in the General Assembly stated 'we realise this project is more a need than an opportunity and, therefore, we must undertake it'. Four conditions were defined: (a) the number of jobs for members should not be reduced; (b) possible economic losses should have a minimum impact on members' income; (c) the Governing Council should periodically submit information about the operation, and (d) managers involved in the project should accept an ethical commitment 'not to quit the project until a satisfactory conclusion has been reached'.

In the General Assembly, the members of the cooperative expressed their concern about the risks entailed in such an operation and about how it would affect the company's financial debt, its cooperative identity and the members' working conditions.

Fagor's managers alerted the members to the risks of not performing the takeover, given the current market situation. As Gómez Acedo, Vice-president of MCC's Household Division put it: '(...) our need to carry out this operation was perfectly understood. When voting, it was vital for members to understand what could happen if the operation were indeed performed, but also what could happen if it were to be refused. Both solutions had pros and cons, but the group opted to accept the proposal'. (T.U., 2005).

Eighty three percent of Fagor's members voted in favour of purchasing Brandt (with 5,700 workers) in two General Assemblies held in Mondragón and Basauri. In so doing, members submitted to the pressure of competition and adopted a new decision that will accelerate Fagor's transformation into a multinational company. Cooperative members, who now represent no more than one third of the total workforce (including Fagor and its subsidiaries), are now confronted with the dynamics of large-scale takeovers and rationalisations within a context of competition between multinational corporations subject to stock market quotations. They must accept the closing down of some of the absorbed companies' plants and must define the limits of ownership and participation rights for subsidiary workers. Members of the cooperative are as yet uncertain about whether they will be able to continue creating wealth and jobs in their community. These doubts will be resolved in the near future when Fagor presents its 2006–2009 strategic plan to its members, along with the industrial plan that will determine the factories, investments and staff with which the group will operate.

Furthermore, we should point out that in February 2006, less than one year after the takeover of Brandt, Fagor appointed a new general manager. Fagor's negative results during 2005 (which without MCCs support mechanisms would have totalled at least 15 million euros), coupled with disagreements within the Governing Board mainly related to the management model employed, generated a crisis in the government of the cooperative, which was eventually resolved by MCC reassigning the former general manager to the supervision of the corporation's strategic projects.

### *3.3.3. Efficiency Dilemma: Local Employment versus External Employment (Expansion and Relocation)*

As we mentioned before, what makes Fagor different in the international relations arena is the fact that it is firmly rooted in its places of origin. The

European household appliance sector is clearly being offshored to Eastern Europe and Asia. Many companies have moved their production plants to countries where costs, and especially salaries, are lower.

During a recent visit to Mondragón, Joseph Stiglitz (T.U., 2005) expressed the opinion that conventional multinational corporations do not feel responsible for the job destruction entailed in relocation, while cooperatives do have that responsibility. Fagor's managers must deal with a cooperative under the control of worker members and will therefore be reluctant to offshore cooperative production. On the one hand, Fagor cannot close its Mondragón plants and move to places where production is cheaper; and on the other, the challenge of global competition poses great difficulties for maintaining the current number of local jobs.

International expansion started as a need to access new markets, but it is now threatening local employment. The new pricing policy has caused Fagor's low-end products, mainly those with the lowest value added, to become uncompetitive in their traditional locations. Their production is therefore being transferred to the *Wrozamet* plant in Poland. This process has only just begun, but it may cast long shadows over the future of some cooperative jobs.

The purchase of Brandt aims to consolidate cooperative employment in the Basque Country. Although it may seem paradoxical to buy a company in a country with high labour costs, this allows Fagor to obtain a significant market share in France. If activities must be offshored or production reorganised, as may happen, Brandt's plants will be affected much earlier than the Mondragón plants. In fact, the French plant in Lesquin (670 workers) was closed before the takeover and it is very possible that the dishwasher manufacturing plant in La-Roche-sur-Yon will be moved to Mondragón, thus affecting 300 people. Closing down additional Brandt plants cannot yet be ruled out. This could be the case with the Italian Verolanuova plant (700 workers), which may have its production transferred to Wrozamet (Poland). As various trade union sources in Brandt have pointed out: 'Fagor will give everyone a lot to talk about as regards restructuring', although such processes will not only affect the French company, but also local and cooperative employment.

Over the last few years, Fagor has made important investments and launched new activities in its Mondragón plants, but Fagor may already have reached its peak with regard to local and cooperative employment, which may slowly decline from now on, while the external nonmember employment rate may retain its upward trend. Nowadays, the local workforce does not even account for 40% of the total, while cooperative (member) employment only accounts for 30%.



This restructuring process will mainly affect blue-collar workers, with job creation still being possible to a lesser extent in corporate services such as research, design, administration and finance. New investments, where capital is increasingly more important, and relocation, will mainly affect temporary workers, whose possibilities of gaining a job, let alone becoming members, have been dramatically reduced. In order to maintain the competitiveness of local jobs, workers will be under great pressure to increase productivity over costs, and this will likely result in salary reductions and poorer working conditions.

#### *3.3.4. Identity Dilemma: Cooperative Identity versus Multinational Corporation*

The least developed point, though not the least important one, is the cooperative socio-economic model in Fagor's expansion policy. Expansion was based on takeovers and subsidiaries with exclusive or shared equity participation. This has transformed Fagor into a multinational company combining cooperative companies and corporate enterprises.

Relations between capital and work in the subsidiaries determine the cooperative balance of Fagor's external development. It has been noted that working conditions and relations in Fagor's subsidiaries do not so much depend on the cooperative features of the parent company, but rather on the conditions existing in the country in which each subsidiary is established. There are two main factors to be taken into account: each country's legal requirements and the behaviour of other companies in the same sector, especially multinational companies.

Wrozamet is a company with a strong trade union presence that was privatised by the State. Therefore, the economic and social bid made by the cooperative in order to purchase it included the possibility of workers' representatives attending Management Board meetings. According to the Governing Council, since Morocco's conditions make it difficult to develop new corporate models, Fagor is focusing on professional and technical training there. In China, there is a commitment between Fagor and its local partners to guarantee certain basic social-labour conditions for the workers, in accordance with ILO guidelines, but this has neither been formalised nor supported by any certificate or audit.

Equal distribution of wealth through profit sharing, an easily implemented basic cooperative approach entailing no legal or cultural difficulty, is not a common practice. There is a debit balance when dealing with foreign plant workers' participation, meaning participation in management, profits and ownership. This is true at subsidiary, cooperative and corporate level.

The relationship between subsidiaries and their communities, based on concepts such as corporate social responsibility, is now becoming increasingly important in conventional companies and constitutes another important issue in the cooperative arena.<sup>11</sup> In this respect, the University of Mondragón has signed agreements with the University of Wrocław in order to work together in the field of student training and exchange, the idea being that Wrozamet could hire those students in the future.

Fagor's main focus of attention is the industrial and commercial development of foreign plants, with social policy design being pushed somewhat into the background. The social policy of international expansion has been characterised by the absence of an explicit policy. Fagor has been, and still is, hesitant about 'opening Pandora's box', since there are many difficulties involved in transferring the cooperative model to foreign subsidiaries. Fagor's Strategic Plan for 2005–2008 defines the main guidelines of the cooperative Code of Ethics for subsidiaries. This Code is in keeping with the agreement reached during the 7th Cooperative Congress of MCC, held in May 2003, in which the corporate policy for 2005–2008 was approved. During this congress, a new 'corporate expansion' was adopted to integrate new business units and affiliates in accordance with MCC's principles and values, but without transforming public limited companies into cooperatives. Two main areas of action were adopted: the encouragement of workers' participation in subsidiaries, and the assumption of a social liability commitment aimed at promoting active social and environmental policy implementation both internally (workers) and externally (community).

In 2004 MCCs plans for developing the corporate expansion policy included working with a few subsidiaries as the testing ground. The plan, coordinated by the corporation, chose three mature, consolidated subsidiaries belonging to three key cooperatives: Copreci's subsidiary in Guadalajara (Mexico), Ederlan's subsidiary in Boutacu (Brazil) and Fagor's subsidiary Wrozamet (Poland). The aim of the study was to allow the corporation to create a model in which workers will be able to participate in the ownership of their companies. The idea was to ensure that by 2006, the workers in the said subsidiaries owned 30% of the capital. However, no significant progress has been made in any of the three pilot companies. In addition to the difficulties inherent in such an undertaking, the enormous competitive pressure, changes in the management of the subsidiaries themselves and, mainly, the lack of commitment from the cooperatives' governing bodies, have all meant that the said projects have failed to provide the expected results.

A deep-rooted alteration in cooperative identity has been observed throughout the whole Group as a consequence of purchasing operations and the creation of subsidiaries. Fagor's cooperative members have somehow become capitalist employers. Although there is some concern about this, the possibility of creating a new, more democratic form of multinational cooperative cannot yet be discerned.

### *3.3.5. Strategies for Overcoming the Dilemmas: Innovation and Cooperation*

Innovation is the key factor for dealing with this phenomenon of relocation. It is not a case of how many jobs are going to be lost, but how many new activities and jobs are going to be created. In this sense Fagor's challenge will be to increase the added value that makes its products different, i.e. to try and strengthen competitive factors related to new technology incorporation through training, innovation and development processes. In this respect, Fagor enjoys the advantages of being a member of MCC, especially with respect to training and innovation, whose main elements are the University of Mondragón and the *Garaia* innovation centre (Bakaikoa et al., 2004). The latter is promoted by MCC, scientifically supported by University of Mondragón and the Ikerlan Technology Centre, and backed by a number of different public institutions. Garaia aims at establishing a fruitful cooperation between the university, technology centres, and companies in order to make an important long-term qualitative leap in the field of research and to foster the use of new technologies through higher competitiveness and updating of the industrial base.

Over the last few years, Fagor has incorporated innovative features into existing products, thus improving design, components, execution deadlines and product features. The torchbearer of Fagor's new activities is domotics, which makes it possible for household appliances to be interconnected through a computer or externally connected through the telephone line. However, Fagor also participates in a number of joint new activity launch processes such as Rotartica, S.A., with Gas Natural, in which a gas air conditioning device has been developed and will now be marketed and used in houses and stores. Fagor has also been involved with MCC in the start-up of Ibai Coop., a drying and ironing system. In the same way, Ekisun, S.A. can now develop solar photovoltaic systems thanks to the support of Fagor Ecotecnia and MCC Investments<sup>12</sup> (Table 5).

MCC cooperatives, including Fagor, are eager to develop this type of innovative processes. Mr. Catania, MCC President, affirms that 'these activities will allow us to fight relocation by creating added-value here and fostering wealth and job creation at a national level'. Nevertheless, new activity or

**Table 5.** Equity Participation in New Activities.

Members	Rotartica, S.A. (%)	Ibai, S. Coop. (%)	Ekisun, S.A. (%)
Fagor Electrodomésticos, S. Coop.	57.14	63.80	35.00
Gas Natural SDG, S.A.	42.86		
MCC Investments		15.95	30.00
MCC Innovation		15.95	
Worker members		4.30	
Ecotecnia Inversiones, S.L.			35.00
	100.00	100.00	100.00

Source: Fagor Electrodomésticos, S. Coop. (2005).

business unit creation is a slow process at a small scale. New businesses require a great deal of investment per worker, which can hardly compensate for the possible job losses caused by the offshoring of traditional activities.

Fagor must face the business challenge, but also the challenge of seeking out a new business model that may reconcile traditional cooperative principles and values with the reality of production and distribution systems at an international level. In this sense, innovation policy is also a fundamental aspect when defining the multinational company model. The ‘centre-periphery’ perspective that prevails in Fagor’s innovation policy, whereby the parent company is the one that exclusively transfers knowledge via subsidiaries and countries, may be called into question from two angles. Firstly, this outlook is becoming obsolete, given that subsidiaries may play a key role in the creation of knowledge according to their location, history, personnel and business model. Recent studies stress the importance of subsidiary companies in the transfer of knowledge towards both the parent company and other subsidiaries (Andersson, 2001). Secondly, from a co-operative point of view, a centre-periphery model in which subsidiaries lack innovative capacity and occupy a secondary position in the knowledge management of international cooperative holdings is simply not valid. To this end, it is necessary to reconsider the unequal distribution of knowledge in internationalisation processes so as to ensure that management systems and innovation processes similar to the ones already existing in Fagor are steadily implemented in its subsidiaries.

#### 4. CONCLUSIONS

Free trade and the increased presence of multinational corporations impose a series of obligations on industrial companies, including the need to attain a

size that allows them to operate globally and be located in the most favourable places from the point of view of costs and market proximity. During the last decade Fagor has transformed from being a Basque Country-based production plant cooperative, to a large multinational group with cooperative plants and multiple non-cooperative production centres in France, Poland, Morocco and China. Fagor has seen the challenge of international expansion as a way of improving competitiveness for the preservation of the local and cooperative employment. Initial relocation operations conducted by Fagor have had the same objective, although their immediate result has been a loss of local jobs. This international productive repositioning policy goes hand in hand with an investment effort in local plants and a gradual transformation of low value-added jobs into higher value-added jobs. In spite of this, however, relocation has only just begun. Industrial cooperatives now wonder how to adapt themselves to the new situation without losing their identities, i.e. how to preserve companies that are deeply rooted in the community and based on a democratic business model. The strategic choice made by the industrial cooperative movement must aim at strengthening competitiveness based on new technology incorporation and on human and social asset development.

The cooperative movement in industrialised countries must also participate as such in the industrial development of the developing world. The issue is how to structure and implement this process. In this respect, there are two main scenarios. The first one features a cooperative centre with a capitalist periphery, submerged in capital strategy and forming an integral part of the spiral process of social regression. The second one features an international expansion system, different from the rest, which underlines the special features of the cooperative process. This process involves an economic, social and political analysis and suggests a global development for all the world's peoples, encouraging a quick increase in salary levels as well as the improvement of social-labour conditions in developing countries. This would mean adhering to the social-labour conditions defined by ILO and questioning the logic of exploitation. Due to their identity, cooperatives are obliged to suggest alternatives that include access to ownership, participative management and commitment to the community. Access to ownership can be guaranteed by implementing formulas that will allow workers in those countries to totally or partially own the companies in which they work. Participative management can be guaranteed by calling for the implementation of management systems and innovation processes, which will be similar or equivalent to those existing in the cooperatives of origin.

Commitment to the community can be guaranteed applying a principle stating that any capital gain generated in any given country shall be reinvested within that country's territorial boundaries. However, development that is to be positive for the whole community requires communication within the global company, as well as between workers' representatives in the new companies and social councils and/or trade union representatives in the cooperatives established in the countries of origin. Initiatives and proposals made by these joint platforms are vital for the consolidation of a line of conduct in keeping with that described above.

This theory may lead us to consider the key issue of the development model, i.e. the balanced, supportive and integral development of human communities. This means that each settlement must consider the nature of productive insertion into globalisation (and into European construction, in our case), salary levels, the technologies implemented, training and qualification systems, the infrastructures used, relations with the community, relations with other communities, value systems, social conquests and participation systems.

The idea is to generate a collective and participatory effort aimed at channelling energy, resources, potentialities, qualifications, creativity and motivation in a constructive way, in order to meet all the needs historically accumulated in each specific community. All this will be feasible provided that we explore democracy and social conquests in greater depth, broadening the scope of rights and developing sovereignty in different communities, focusing always on alternatives arising from the working environment, rather than from the capital environment.

## NOTES

1. The existence of subsidiary companies distributed between the countries of origin and other areas of the world modified the traditional policy of cost control, giving priority to strategic factors that assess 'global profitability' throughout the entire internationalised company.

2. As in the case of the Mondragón Group co-operatives.

3. Companies may be at risk if they do not have the profit margin, since their owners require max. return on their investment.

4. This would mean the realization of economic activities in the European Union under the labour laws of the regulations of the country of origin.

5. Authors as [Lipietz \(2004\)](#) explain clearly the problem. In that way, freight and logistics benefit from re-location to the detriment of high room-waste and severe environmental problems.

6. As a member of MCC, the largest industrial group in the Basque Country, Fagor enjoys a number of logistic and financial benefits. These issues are further developed in Bakaikoa et al. (2004).

7. Among the studies of Fagor and the MCC are Whyte and Whyte (1991), Kasmir (1996), Greenwood and Gonzalez (1991), Cheney (1999). Among the founders: Larrañaga (1998) and Ormaetxea (1999).

8. Although the purchasing offer made by the cooperative was not the highest one, it was preferred by the trade unions, the company and the Polish government. One of the reasons for this was the 'social condition package' offered by the cooperative, which included job maintenance as well as social improvements for workers.

9. <http://www.electrolux.com>

10. Another fund controlled by the MCC is the Education and Inter-Cooperative Promotion Fund, made up from 2% of the gross profits of each cooperative. These funds finance cooperative training, as well as research and development of new technologies.

11. The seventh cooperative principle included in the 'Statement on Cooperative Identity' refers to interest in the communities where cooperatives are established: 'Cooperatives work for the sustainable development of their communities through policies approved by their members'. (<http://www.coop.org/ica/es/esprinciples.html>).

12. Fagor has also recently launched the exclusive new technology Fagor NetComp@tible, which allows remote diagnosis and remote control of household appliance functions.

## REFERENCES

- Andersson, U. (2001). *Network embeddedness and transfer of information and innovation in the MNCs*. Universitetsstryckeriet: Uppsala University.
- Bakaikoa, B., Errasti, A., & Begiristain, A. (2004). 'Redes e innovación cooperativa'. *CIRIEC-España*, 49, 263–295.
- Baron, A. (2004). Le Monde du Travail face aux Délocalisations. World Economic Outlook IMF, September.
- Bonnet, M. (2001). Délocalisations: Avantages et Inconvénients. Available at: <http://tphailande.free.fr>
- Borja, A. (2006). Deslocalización de Empresas: Temores Excesivos o Peligros Reales. *Revista de Relaciones Laborales*, 16.
- Centre Confédéral d'Etudes Économiques et Sociales (2003). Délocalisation, Externalisation, Sous-traitance. *Note Économique* 69, March/April.
- Cheney, G. (1999). *Values at work*. Cornell University Press: New York.
- Clamp, C. (2000). The internationalization of Mondragón. *Annals of Public and Cooperative Economics*, 71, 1–22.
- Errasti, A. M., Heras, I., Bakaikoa, B., & Elgoibar, P. (2003). The internationalisation of cooperatives: The case of the Mondragón cooperative corporation. *Annals of Public and Cooperative Economics*, 74(4), 553–584.
- Greenwood, D., & Gonzalez, J. L. (1991). Industrial Democracy as a Process: Participatory action research in the Fagor Cooperative Group of Mondragón. Van Gorcum, Netherlands, and Stockholm: Swedish Center for Working Life.

- Husson, M. (2005a). A Propos des Délocalisations. Available at: <http://hussonet.free.fr/mondiali.htm>
- Husson, M. (2005b). La Mondialisation, Nouvel Horizon du Capitalisme. Available at: <http://hussonet.free.fr/mondiali.htm>
- Larrañaga, J. (1998). *El Cooperativismo de Mondragón. Interioridades de una Utopía*. Aretxabaleta: Azatza (Otalora).
- Lipietz, A. (2004). Les délocalisations son-elles inévitables? *Les Verts au Parlement européen*, 13, 10.
- MCC (2006). Actualizaciones del Plan Estratégico Internacional 2004–2008. Mondragón.
- Mendizabal, A. (1998). La Globalización. Edit. HIRU, Donostia.
- Mendizabal, A., Zurbano, M., Sarasua, J., & Udaondo, A. (2005). *Globalizazioa eta Autoeraketa*. Ezkoria: Mondragón Unibertsitatea.
- Myro, R., & Fernández-Otheo, C. M. (2004). Los Mitos de la Deslocalización. *Foreign Policy*. Fride, October–November.
- Ormaetxea, J. M. (1999). *Orígenes y Claves del Cooperativismo de Mondragón*. Aretxabaleta: Euskadiko Kutxa.
- Torres, S. (2004). La Globalización, las Deslocalizaciones y la Clase Obrera Industrial. *Rebelión, Economía*, pp. 15–35.
- T.U. (2005). Trabajo y Unión. *MCC Journal*, (March), Aretxabaleta.
- Whyte, W. F., & Whyte, K. K. (1991). *Making Mondragon: The growth and dynamics of the worker cooperative complex*. Ithaca, New York: Cornell University, ILR Press.



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# A NOTE ON THE FUTURE AND DYNAMICS OF ECONOMIC DEMOCRACY

Jaroslav Vanek

## 1. INTRODUCTION

It may be useful to begin this discussion with a brief history of the subject; not the whole history starting from Buchez, the Utopians and Rochdale, but the more recent history beginning after the Second World War. Following that war the winning systems were both capitalist systems, one based on private capital ownership, the second based on state capital ownership. That is, both systems were seeking to serve the interests of capital – one that of the private owners, the other the interest of the state – as if the workers were just a resource to serve capital. More concretely, especially with respect to the western private capitalism, the system worked as if profits were to be maximized, that is the incomes and well being of the workers were to be minimized.

By contrast, many intellectuals and practitioners somehow intuitively felt that there is something “rotten in the state of Denmark.” Especially in the West, priding itself on its democratic principles, the question arose why there should not be democracy in all domains of human life, both the political and the economic.

If such reflections were based just on an intellectual exercise, the whole matter might have gone to sleep and disappeared. But there were some concrete developments in the real world. We may concentrate on two, specifically the Yugoslav system of self-governing socialism and workers' councils stemming from the socialist tradition in the East; and in the West, the experience of Mondragon in Spain, stemming from the traditions of Rochdale and the social doctrines of the Catholic Church. Of course there were many other experiences such as the hopes of the Prague Spring of 1968, but at this stage of our discussion they do not have to concern us.

What must also be noted in defining our subject are the many attempts, especially in the West, which tried and are trying to introduce participation by workers not based on their personal rights but based on the rights of worker ownership, in particular the development of the Employee Stock Ownership Program (ESOP). But this subject, whether good or bad, also does not concern us in the present paper.

## **2. THE POST-WORLD WAR II REAL WORLD IN OUTLINE**

Our uneasiness about the dominant presence of two capitalist systems – private in the West and state in the East – was vindicated to a considerable degree by real events of the past half-century. Starting from “the bottom of the pile” the Soviet system, where the state controlled both the political and economic spheres, collapsed, so to speak, of its own weight. And in this process it was assisted by the presence of the virulent western economies.

In the West, priding itself on its political democracy, the system of private capitalism combined with the market mechanism also did not fare very well. With free markets of all, including the (quasi-slave) market for human labor, enormous surpluses were realized, increasing without limit the power of the major holders of capital. And this power spilled over into the political domain to the degree where we can now speak of dollar-crazy rather than democracy.

The Yugoslav system, wherein the asymmetry of the West occurred in reverse, with a one-party state political power and an attempted worker participation in the economic domain, also had a hard time to survive. This was especially so for two reasons: first, the historical divisions within Yugoslavia; and second, the foreign policies of the West which never appreciated the Yugoslav experiment in economic democracy.

A more subtle observation is in order. The two perhaps most successful western economies, those of Germany and Japan, performed exceedingly well while they practiced some degree of worker participation: in Germany through the system of co-determination, and in Japan through a “family-like” position of the worker in the enterprise.

Most remarkably and meaningfully, the Mondragon system, born soon after the Second World War, not only survived but also expanded and underwent some positive organic transformations. However, our hopes of witnessing a multiplication of new Mondragons throughout the world were not realized. We will return to this subject later in our paper, later, after having presented something that allows us to bring more order into the conceptual framework suggested by the real events sketched in this section.

Indeed it is necessary to develop an analytical framework, which would allow us to categorize and further evaluate the systemic state of the world just outlined. We do so in the next section by summarizing what I call the “Unified Theory of Social Systems.” For the reader who may want to have a deeper understanding of the subject, I refer to my self-published study of the same title (Vaneck, 2000).

### **3. UNIFIED THEORY OF SOCIAL SYSTEMS: AN OUTLINE**

Thus we live in a dollar-crazy world where dollars of capital control the economy and its enterprises: where capital controls monopolistic and oligopolistic markets, and where enormous capitalist fortunes control, through campaign financing, most of the political process; where the poor members of society are far less likely to vote than the wealthy, who in addition to their disproportionate voting participation, also have far more leisure to construct their political “ambushes.”

To get out of this mess and to be able to design an optimal way forward, we must secure fundamental laws, which should be self-evident:

1. Neither slaves nor human labor are marketable commodities. Human beings are the very subjects of social participation and they cannot be, like slaves, subjects of the market mechanism, whether as persons, or providers of servile labor.
2. Social/human groups must participate in the determination of their joint interests.

3. Such participation in social decisions must be governed by the *intensity* of involvement (e.g., one person, one vote in the case of social equality, or the well-known capitalist principle of one share, one vote).
4. Participation in social decisions must also be governed – and this is the major innovation of our optimal strategy – by the *nature* or *quality* of involvement, in categories that are qualitatively distinct and cannot be quantitatively compared to each other. For example, the quality of involvement of workers in an enterprise is categorically distinct from the involvement of the stockholders who may never have seen the factory they own, and who are most likely to hold an atomized portfolio of dozens of securities.
5. Finally, there are the methods, frequency, and structure of participation, which will determine whether participation is better or worse.

It is quite obvious that under all five headings there is a broad potential variability, such as self-determining labor or labor contract under [2], the limitless variability of portfolio ownership under [3], or frequency of voting under [5]. The variability under [4] is the very cornerstone of the unified theory and also the foundation of the fundamental theses of this paper.

While the quality of involvement can be multifarious and defined by each particular case, it is possible to list the most fundamental categories. They are: (1) intellectual involvement, (2) indirect involvement, (3) direct involvement, (4) vital involvement, (5) parental involvement, (6) spiritual involvement, and (7) loving involvement.

To give just one application, showing the perversity of our dollar-crazy world, we note that typically the workers of capitalist enterprises who are very seriously, directly if not vitally involved, have no participation in decisions and are subject to profit maximization, whereas the stockholders, whose involvement is indirect and most often atomized, possess the total power of decision, exercised either directly or indirectly through appointed boards or managers. In addition and perhaps more gravely, the situation here is one negating the first fundamental principle of optimality.

#### **4. LOOKING AT THE REAL WORLD**

As we noted already, the Mondragon system survived so to speak with flying colors in the time when other world systems either perished or were undermined. It underwent significant internal changes of structure, but these were perhaps a stimulus rather than a hindrance to the growth of the system.

It survived in spite of an oligopolistic capitalist environment exercising pressure on a small and alien cooperative species.

But as we have seen, we did not witness a proliferation into additional Mondragons numbers 2, 3, 4, 5, etc. throughout the world. Perhaps it was the special conditions in evolution, so well described in the BBC film, that brought about Mondragon, including the person of Father Jose Maria Arizmendi that permitted this unique occurrence.

But now we are witnessing a new and unexpected phenomenon, which is the main focus of this analysis. Mondragon like the entire western industrial world has been increasingly subjected to violent global forces where productive resources, best illustrated by the Chinese economy, became more available at costs dramatically lower than in the western capitalist world. Most significantly, we think here of wages more than a thousand times lower. And we need not remind ourselves of the fact that just about everything transportable is flooding American and western markets, produced in low-wage countries and generating catastrophic trade deficits for the rich countries.

Obviously the Mondragon industries selling in the same markets face similar if not identical forces of competition. And here the Mondragon system had to seek its own modes of adaptation. This was done not by creating new Mondragons in other parts of the world, but rather through creation of satellite or infant industries outside of Spain by individual large Mondragon firms.

For a superficial observer, especially an economist of the western neo-classical capitalist tradition, this was judged as a multinational-type exploitation (so well known from the present-day global markets) of cheap labor abroad. But on closer scrutiny, with the analytical tools outlined earlier, this may be an erroneous conclusion.

The different large industrial firms of Mondragon have by now (writing in 2005) created around the world in various countries their “offspring” firms using the technologies, skills, and technical organization of the parent firms. There are perhaps a dozen such firms in Central and Eastern Europe. The largest one, employing some 1,500 workers, is found in Poland and some half-dozen exist in the Czech Republic. Two of them I have visited and studied personally in 2004. I report on these experiences in the following section. In concluding this section, I can state a strong presumption that what we are witnessing here is not a case of multinational type exploitation, but rather, in the spirit of Section 3 earlier, a case of parental involvement of the Mondragon mother firms. These appear to be “infants” of the Mondragon parents, undergoing – or to undergo – a family evolution

passing from infancy through adolescence to maturity. And the forces surrounding such growth are most likely to resemble the evolution of healthy family relationships.

## 5. MY VISIT WITH TWO AFFILIATE FIRMS

We now turn to our description of two specific cases of infancy. At the biennial meeting of the IAFEP association in Halifax, I learned from Professor Anjel Errasti that satellite/offspring firms were established in my old country of the Czech Republic, specifically in locations near the old historic city of Olomouc in Moravia. We arranged to meet in Czech Republic, Professor Errasti using some of his holidays, with the intention to visit these firms.

We visited two firms of between 100 and 200 workers. They use very advanced technology and equipment, for the most part, based on machinery brought from the parent firms in Spain. However, it can be said that the technology is "in progress." In one instance a possibility was discussed of replacing a labor-intensive segment of the production process by a more automated one; in that case, however, the cost of such substitution was quite considerable, and thus the decision was not yet taken in an environment of considerable excess availability of labor.

The location of both firms is determined among other factors by the proximity of markets, that is several firms producing kitchen stoves in central and eastern Europe using the Mondragon supplies of component parts, in particular electric hot plates and gas stove burners; but other components are also produced, such as high quality heat-controlling sensor for ovens. The firm producing electric hot plates actually acquired a formerly shut-down foundry to produce the metal plates.

Wages are obviously far less than incomes in the cooperatives in Mondragon, but their level in Moravia is clearly quite attractive, given the scarcity of employment opportunities. Actually in one of the firms we were told that there is a significant waiting list for employment.

The personnel of the firms are entirely from the local region, with the exception of the Basque directors of the two firms, respectively. With these two directors we were able to discuss and learn a lot about the operation and spirit of the firms. I was very pleasantly surprised to find a certain sympathy for my concept of parental involvement and interpretation of the satellite firm as a project in progress akin to human development from infancy to maturity. I will elaborate below on this subject.

Even at this early stage (a few years) of existence of these firms, I observed an honest effort on the part of the administration to introduce participative elements into the production process, as realized in the parent firms in Spain. First, we noted that at least in certain stages, where this is possible, a working team can determine job rotations which render the rapid cadence of the process much more acceptable.

Another instance of internal participation was the recording within work groups of defective components, and consultation on that subject with the technical manager on a daily basis. Some members of the top administration were being invited for an internship, working with the parent firm in Mondragon, to acquire organizational and other skills. Other technical personnel on a higher level were designing internal production processes in the firm. Also we took part in an informal gathering of workers in the middle of the morning, discussing with the technical direction questions and incidents of faulty components. Last but not least, the management introduced a system of cafeteria luncheons to enhance worker satisfaction. I visited with the kitchen personnel preparing an excellent lunch of smoked meat and sour cabbage and dumplings of such high quality that I regretted we were not participating in the lunch.

## **6. THE SPIRIT OF THE EXPERIENCE**

It was my main concern to test, with the two young directors, the validity of my theses concerning the principles of parental involvement. I sensed that the external critique that the firms resemble capitalist-type multinational propagation through direct investment was very much on their minds. One could even say that they felt uncomfortable, not only about the external critique, but also in the context of their personal consciousness. After all the firms, while working very efficiently and successfully, produce surpluses akin to capitalist profits, or akin to the surpluses within the Mondragon mother firms. But of course those surpluses do not go to stockholders, but rather are allocated in a not quite clearly defined manner to various community purposes of the Mondragon system.

Having written a short note, which was read by the two directors, I sensed their psychological sympathy with the concept of parental relationship. It was as if some of their critical concerns were somewhat appeased. In our discussions I felt that coming from the world of economic democracy of Mondragon, it is their honest desire ultimately to transform their firms into a species resembling that of their origin rather than an alien species of



capitalist dependency and exploitation. And it is my hope, as suggested in the appendix considerations, that an avenue in that direction can be found. The paper of Professor Errasti for the Halifax conference elaborates in some detail on the possible modalities of such transformation (Errasti, Bakaikoa, & Begiristain, 2004).

## 7. A HOPE FOR THE FUTURE

Those of us who hoped over the past fifty years to find a road towards an expanding economic democracy in the world were disappointed because Mondragon grew in itself but we did not witness a broad worldwide proliferation of other Mondragons. But what I witnessed in Moravia and other parts of the world with satellite “infant” firms may give us new hope. If it is possible to create new democratic firms along the lines here outlined and bring them through adolescence to maturity, and if such mature offspring – like the human species – could further procreate along a pattern similar to that adopted by the parents, there may be hope, in the sense of our Section 2 above, to move to a world of optimal participation, and not a world of exploiting capitalism.

Without going into the details, there should be such a possibility. Indeed a typical parent on the one hand – in the context of our discussion – and the offspring on the other, are both in a position to benefit from the experience. The process of maturation from infancy to adulthood should be based on dialog of those involved, finding the optimal process (in economists’ language, moving toward the contract curve) beneficial to all involved.

## REFERENCES

- Errasti, A., Bakaikoa, B., & Begiristain, A. (2004). Cooperatives as multinationals: The Mondragon case. Paper presented at the 12th conference of the International Association for the Economics of Participation, IAFEP. Halifax, July.
- Vanek, J., (2000). *Unified theory of social systems: A radical Christian analysis*. Cornell University Press. Available at: <http://dspace.library.cornell.edu/handle/1813/642> or <http://hdl.handle.net/1813/642>.