RECIPROCAL EXCHANGE NETWORKS: Implications for Macroeconomic Stability

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Abstract: Reciprocal exchange networks or "barter rings" in the US and Switzerland do billions of dollars of trade each year. Their turnover is shown to be highly counter-cyclical. Most studies of the internet's macroeconomic impact have focused on price and inventory flexibility. The macroeconomic impact of Swiss reciprocal exchange networks, founded in the early 20th century, has not been widely studied. The experience of these networks suggests that the credit they provide during recessions is highly stabilizing. This has important implications for monetary theory and policy.

I. Introduction

Faster and cheaper information on the internet means greater macroeconomic stability. That, at least, is a well-publicized view of internet-based commerce. By making it possible for purchasing firms and households to compare prices more widely, e-commerce has forced better price flexibility and greater resistance to inflation (Greenspan, 1999). Better supply tracking and demand estimation also helps keeps inventories lean, thus tamping down unplanned inventories (Wenninger 1999), an important precursor of recession.

But this literature on *price* and *inventory* flexibility has ignored another way that better information can be macro-stabilizing. As any loan-officer or central banker can attest, the prudent allocation of *credit* is both knowledge-intensive and highly uncertain. What if, instead of trying to estimate the proper amount of money and credit to complete all transactions, current values bid by each potential purchaser, and asked by each potential seller, were precisely known by a central clearing house? The problem of how much money-stuff to create to balance aggregate supply and demand would largely disappear; money in the conventional sense would no longer exist.

Such moneyless exchange took place in the ancient storehouse economies of the Middle East and the Americas (Polanyi 1947), and in the simplified models of microeconomic exchange -- both under conditions where the relevant information is

centralized. The ancient storehouse economies collapsed, and *monetary*[1] systems evolved because the information required to coordinate a complex economy was far too great to be centralized (Stodder 1995). The internet is once again making large-scale information-centralization efficient, and *centralized barter* is an emerging form of e-commerce. Barter clearing-houses are growing with internet companies like swap.com, BarterTrust.com, and uBarter.com (Anders 2000).

The implications of moneyless business are neither straightforward, nor without controversy. A few prominent economists have speculated that computer-networked barter might eventually replace our decentralized money -- as well as its centralized protector, central banking. Such questions have been asked by leading macroeconomists like Mervyn King, presently the Governor of the Bank of England (King 1999, Beattie 1999), and Benjamin Friedman of Harvard (1999).

Friedman's view that central banking may be seriously challenged was a lead topic at a World Bank conference on the "Future of Monetary Policy and Banking" (*World Bank* 2000). His warnings sparked a pair of skeptical reviews in the *Economist* Magazine of London (2000a, 2000b). But no one, as far as I know, has looked at the direct evidence on this issue, the large-scale barter networks in existence for decades.

II. Statement of the Argument

If barter is *informationally-centralized* - on a network where, via a central resource, all parties can scan each other's bids and offers - it will tend to be counter-cyclical. The central record of the value of such barter will track the bids (unmet demands) and asks (excess supplies) of all agents on the network. This is far more knowledge than is available to any "central" bank -- the knowledge it has to set the money-supply basis of exchange. Its broad monetary aggregates sit atop the decentralized "real" data in which investors and central bankers are interested. To get at this information, the bank can only scan *indirect* monetary indicators -- ratings of credit-worthiness, and statistical leading indicators.

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[1] The word “monetary” stems from the Latin *Moneta*, a surname of the mother goddess Juno, in whose temple Roman coins were cast (Onions, 1966). The epithet *Moneta* is usually derived from *monere*, “to remind, admonish, warn, advise, instruct.” Such are not only traditional maternal functions, but among the chief information services of money.

The Romans, however, were not perfectly consistent in explaining this connection. Platner’s *Topographical Dictionary of Ancient Rome* (1929, pp. 289-290) notes that “Various explanations were given by the Roman antiquarians of the epithet *Moneta*. Cicero … says that it was derived from the warning voice of the goddess, heard in the temple on the occasion of an earthquake…. Suidas … states that during the war with Tarentum the Romans, needing money, obtained it by following the advice of Juno; and that in gratitude they gave her the epithet *Moneta* and decided to establish the mint in her temple.”

Note that this second story has the etymological precedence reversed – Juno is called *Moneta* because of her identification with money. The connection between money and the ancient storehouse economies, as noted by Polanyi (1947), may hold the key to this ancient conflation of meanings: stores in Juno’s temple may have performed a *monetary* function long before coins were in wide circulation.

Of course a centralized barter administration can still make mistakes, extending credit too much or too little. Credit "inflation" was indeed evident in the early history of the world's largest barter exchange, the "Economic Ring" (Wirtschaftsring, or WIR) of Switzerland (Defila 1994, Stutz 1994). Such a centralized barter exchange, however, will have a better knowledge base on which to extend credit than any central bank.

The WIR was inspired by the ideas of an early 20th-century economist, Silvio Gesell (Defila 1994). Keynes devotes a chapter of his General Theory (1936; Book VI, Chapter 23) to Gesell's ideas. Despite criticisms, Keynes acknowledges that this "unduly neglected prophet" anticipated some of his own ideas. This link with Keynesian monetary theory should have made Gesellian banking of some interest to macroeconomists.[2] Only one contemporary economist, however, seems to have studied the macroeconomic record of WIR, the largest and most long-lived bank of this sort. Studer (1998) finds positive correlation between WIR credits advanced and the Swiss money supply, M1. This suggests that WIR follows a counter-cyclical credit "policy," one parallel to the monetary policy of the Swiss central bank itself. The data used in Studer's study, however, go back only as late as 1994.

The present paper examines the historic data on two large barter exchanges -- the WIR, founded in 1930s Switzerland, and the International Reciprocal Trade Association (IRTA), founded in the US in the early 1970s. The data will show that the economic activity of both exchanges is counter-cyclical, rising and falling *against,* rather than with, the business cycle.

III. The Data

Because the financial record of these exchanges is not widely known, I provide the basic data. The North American data are available online (IRTA 1999). In the regressions to follow, I have only used the series up to 1995, as the website states that the more recent years are extrapolations.

[2] Keynes notes that "Professor Irving Fisher, alone amongst academic economists, has recognised [this movement's] significance," and gives his own prediction that "the future will learn more from the spirit of Gesell than from that of Marx."

Table 1: Volume of Corporate Barter, North American Companies, 1974-1995 (in Millions of Current US Dollars)

Year	Corporate Trade Companies	Trade Exchanges	Total Corporate Companies & Trade Exchanges	Number of Trade Companies	Number of Trade Clients
1974	$850	$45	$895	100	17,000
1976	$980	$65	$1,045	120	24,000
1977	$1,130	$80	$1,210	150	30,000
1978	$1,300	$110	$1,410	180	40,000
1979	$1,500	$165	$1,665	230	60,000
1980	$1,720	$200	$1,920	280	70,000
1981	$1,980	$240	$2,220	340	90,000
1982	$2,200	$270	$2,470	330	100,000
1983	$2,440	$300	$2,740	350	110,000
1984	$2,680	$330	$3,010	370	120,000
1985	$2,900	$380	$3,280	390	140,000
1986	$3,200	$440	$3,640	410	160,000
1987	$3,470	$500	$3,970	430	180,000
1988	$3,750	$566	$4,316	440	200,000
1989	$4,050	$636	$4,686	450	220,000
1990	$4,550	$707	$5,257	470	240,000
1991	$5,100	$781	$5,881	500	260,000
1992	$5,570	$858	$6,428	540	280,000
1993	$6,050	$938	$6,988	570	300,000
1994	$6,560	$1,084	$7,644	610	340,000
1995	$7,216	$1,248	$8,464	650	380,000

Source: Barter by North American Companies, (http://www.irta.net/barterstatistics.html).
Note that data for 1975 are missing, and in the present study, are given by a linear interpolation. For the regressions, these nominal figures were adjusted by a 1992-based deflator for services, as explained in the text.

These IRTA data are evidently not of the highest quality. Table 1 shows clear rounding-off, and should therefore be considered only an approximation. Whatever biases may have colored the compilation of this data, however, the desire to show a counter-cyclical tendency was apparently not one of them. I know of no empirical studies of the IRTA, apart from my own (Stodder 1998), that claim to find such macroeconomic stabilization. Paradoxically, this is a source of some confidence.

Note that high-quality data on total barter transactions carried out though the IRTA do exist, but are not in the public domain. All commercial barter credits count as regular income and must be filed on Form 1099-B of the US Internal Revenue Service (www.irta.net). Since the IRTA Corporate Trade Council (CTC) for these years showed no Canadian or Mexican companies, it is reasonable to conclude that most of the "North American" barter is US.

Although the US has more complete public economic statistics than almost any other country, the Swiss banking tradition is well-known for the quality of its private records. The WIR bank gives us 56 years of data:

Table 2: Participants, Total Turnover, Credit, and Credit/Turnover, WIR-Bank, 1948-2003
(Total Turnover and Credit Denominated in Millions of Current Swiss Franks)

Year	Participants	Turnover	Credit	Credit/ Turnover	Year	Participants	Turnover	Credit	Credit/ Turnover
1948	814	1.1	0.3	0.2727	**1976**	23,172	223.0	82.2	0.3686
1949	1,070	2.0	0.5	0.2500	**1977**	23,929	233.2	84.5	0.3623
1950	1,574	3.8	1.0	0.2632	**1978**	24,479	240.4	86.5	0.3598
1951	2,089	6.8	1.3	0.1912	**1979**	24,191	247.5	89.0	0.3596
1952	2,941	12.6	3.1	0.2460	**1980**	24,227	255.3	94.1	0.3686
1953	4,540	20.2	4.6	0.2277	**1981**	24,501	275.2	103.3	0.3754
1954	5,957	30.0	7.2	0.2400	**1982**	26,040	330.0	127.7	0.3870
1955	7,231	39.1	10.5	0.2685	**1983**	28,418	432.3	159.6	0.3692
1956	9,060	47.2	11.8	0.2500	**1984**	31,330	523.0	200.9	0.3841
1957	10,286	48.4	12.1	0.2500	**1985**	34,353	673.0	242.7	0.3606
1958	11,606	53.0	13.1	0.2472	**1986**	38,012	826.0	292.5	0.3541
1959	12,192	60.0	14.0	0.2333	**1987**	42,227	1,065	359.3	0.3374
1960	12,567	67.4	15.4	0.2285	**1988**	46,895	1,329	437.3	0.3290
1961	12,445	69.3	16.7	0.2410	**1989**	51,349	1,553	525.7	0.3385
1962	12,720	76.7	19.3	0.2516	**1990**	56,309	1,788	612.5	0.3426
1963	12,670	83.6	21.6	0.2584	**1991**	62,958	2,047	731.7	0.3574
1964	13,680	101.6	24.3	0.2392	**1992**	70,465	2,404	829.8	0.3452
1965	14,367	111.9	25.5	0.2279	**1993**	76,618	2,521	892.3	0.3539
1966	15,076	121.5	27.0	0.2222	**1994**	79,766	2,509	904.1	0.3603
1967	15,964	135.2	37.3	0.2759	**1995**	81,516	2,355	890.6	0.3782
1968	17,069	152.2	44.9	0.2950	**1996**	82,558	2,262	869.8	0.3845
1969	17,906	170.1	50.3	0.2957	**1997**	82,793	2,085	843.6	0.4046
1970	18,239	183.3	57.2	0.3121	**1998**	82,751	1,976	807.7	0.4088
1971	19,038	195.1	66.2	0.3393	**1999**	82,487	1,833	788.7	0.4303
1972	19,523	209.3	69.3	0.3311	**2000**	81,719	1,774	786.9	0.4437
1973	20,402	196.7	69.9	0.3554	**2001**	80,227	1,708	791.5	0.4634
1974	20,902	200.0	73.0	0.3650	**2002**	78,505	1,691	791.5	0.4681
1975	21,869	204.7	78.9	0.3854	**2003**	77,668	1,650	784.4	0.4754

Sources: Data to 1983 are from Meierhofer (1984). Subsequent years are from the annual *Rapport de Gestion* and communications with the WIR public relations department (2000, 2004). The first three series names (Participants, Turnover, and Credit) are given in the annual report in French as *Nombre de Comptes-Participants, Chiffre (o Volume) d'Affaires,* and *Autres Obligations Financières envers Clients en WIR*, respectively. Both Turnover and Credit are denominated in Swiss Francs, but the obligations they represent are payable in WIR-accounts.

IV. The Regression Results

United States

Figures 1 and 2 below give visual evidence of Corporate Barter's "mirror image" or negative correlation with US GDP, and its more positive correlation with Wholesale Inventories.

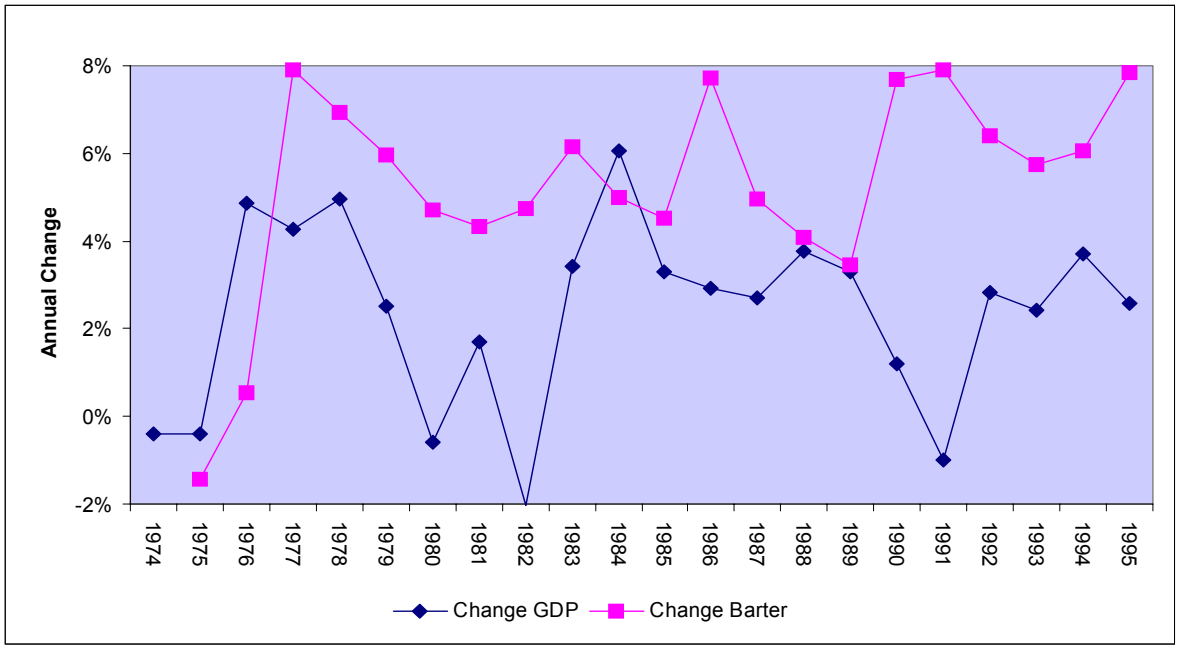

Figure 1: Annual Change in US GDP and Corporate Barter (1992 Prices), 1974-95.

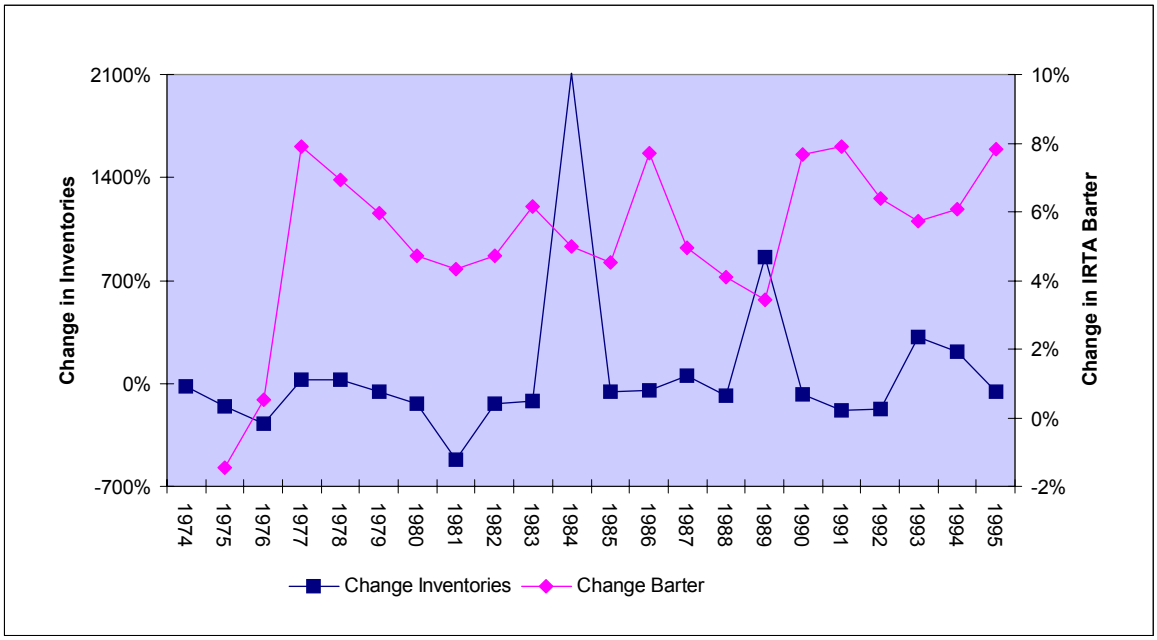

Figure 2: Annual Change in US Wholesale Inventories (left axis) and Corporate Barter (right axis) 1992 Prices, 1974-95.

To deflate the nominal IRTA data of Table 1, the 1992 chained price index for Services was used. By most accounts US corporate barter is heavily weighted toward services (Healey 1996), especially in media and advertising. Gross Domestic Product is in real terms, using a 1992 chained deflator, from the *Economic Report of the President* (1996).

Right-hand-side variables (in Table 3) are a Time trend, Wholesale Inventories, the percentage of Unemployment, and the Gross Domestic Product of the US economy. There is clear multicollinearity between these last two, as demonstrated by the R-squared term being virtually unchanged when either one of them is dropped, in the last three estimates. Inventories show less multicollinearity, going "both ways" in the business cycle -- rising with expected upturns, but also with unexpected downturns. As a result of this independence, the coefficient on Inventories is significant throughout.

Estimates in Table 3 are first-order auto-regressive (AR1). Durbin Watson statistics fall mostly into the indeterminate area, so the null hypothesis of no auto-correlation cannot be rejected at level 5 percent. Regression [4] shows positive auto-correlation. The coefficient on each variable is significant in at least one equation. All coefficients have signs consistent with the hypothesis of barter being counter-cyclical.

Table 3: US IRTA Corporate Barter, as Explained by Macroeconomic Variables
Dependent Variable: Corporate Barter, 1974-1995 (*t-stats in italics, * : p-value < 0.05, ^{o} : p <0.10)*

Equation	**[1]**	**[2]**	**[3]**	**[4]**
Variable				
Constant	**1407.73**	**-344.37**	**2174.86**	**1070.110**
	0.641	*-0.446*	*3.496**	*2.363*
Time	**132.118**	**71.835**	**159.491**	**131.782**
	1.659	*1.977^{o}*	*6.120**	*5.099**
Wholesale Inv.	**15.635**	**17.656**	**14.135**	**8.869**
	*2.801**	*3.512**	*3.825**	*2.719**
Unemploy.	**-0.342**	**55.034**		
	-0.851	*2.172**		
GDP	**18.279**		**-0.468**	
	0.365		*-2.345**	
Regress. Mthd	*AR1*	*AR1*	*AR1*	*AR1*
R-squared	0.892	0.893	0.890	0.861
Adj. R-squared	0.867	0.875	0.871	0.846
Durbin-Watson	1.323	1.271	1.305	0.824
Rho	0.929	0.927	0.929	0.927
t-stat. of Rho	14.788*	14.706*	15.166*	15.014*
Log likelihood	-124.14	-124.60	-124.22	-127.16
Observations	22	22	22	22

Sources: IRTA (1995a) **and Economic Report of the President** (1996). Also, see Stodder (1998).

Switzerland

As Figure 3 below shows, growth in the number of WIR Participants has tracked Swiss Unemployment very closely, consistently maintaining a rate of about one-tenth the increase in the number of unemployed. Indeed, in the following regressions, the Unemployment term is the only one with strongly significant coefficients. The importance of Unemployment to WIR's Participant trend probably reflects its exclusion of "large" businesses, as established in the bank's rules since 1973 (Defila 1994). Employees in smaller firms are generally more subject to unemployment risks. Note that only 40 observations were available in these regressions, since the OECD data on Inventories only go back to 1960.

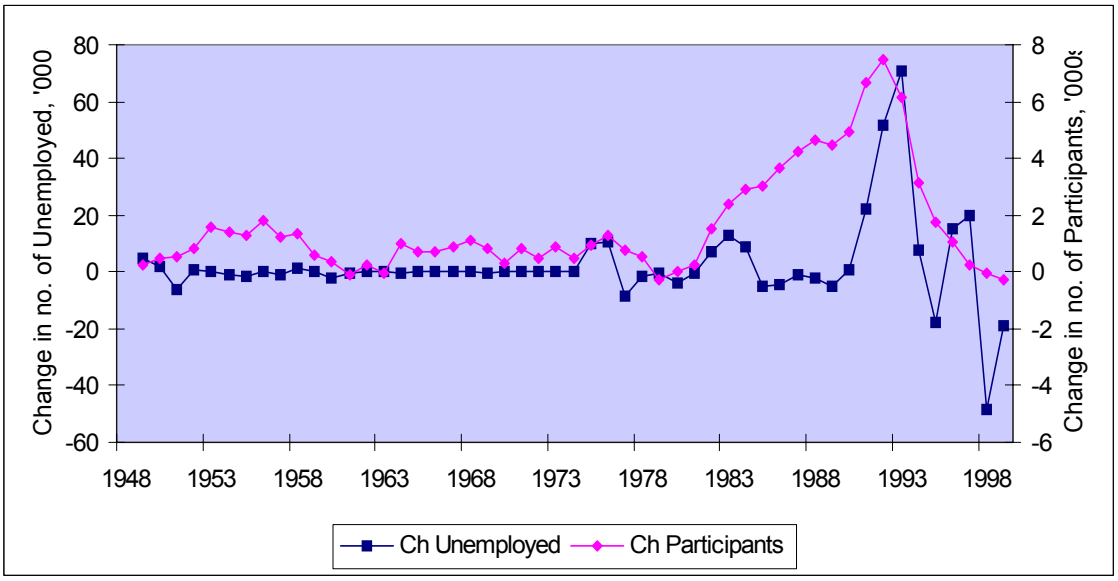

Figure 3: Change in number of Swiss Unemployed (in 1000s, left axis) and in number of WIR Participant-Accounts (in 1000s, right axis), 1948-99.

To deflate the WIR data, a chained price deflator on 1990 GDP is used. In Table 4 the dependent variable is the change in number of Participants. Right-hand-side variables are the Change in Unemployment, Change in Gross Domestic Product, and Change in all Private Inventories -- all in actual and not in percentage terms. The Durbin-Watson statistics show the hypothesis of no positive correlation cannot be rejected at 5 percent. Turnover is seen to be largely pro-cyclical, rising and falling in tandem with the change in GDP and *against* changes in Inventories (See Figures 4 and 6). Credit advanced by the WIR, on the other hand, is highly counter-cyclical, correlated against GDP and *with* Inventories (See Figures 5 and 7).

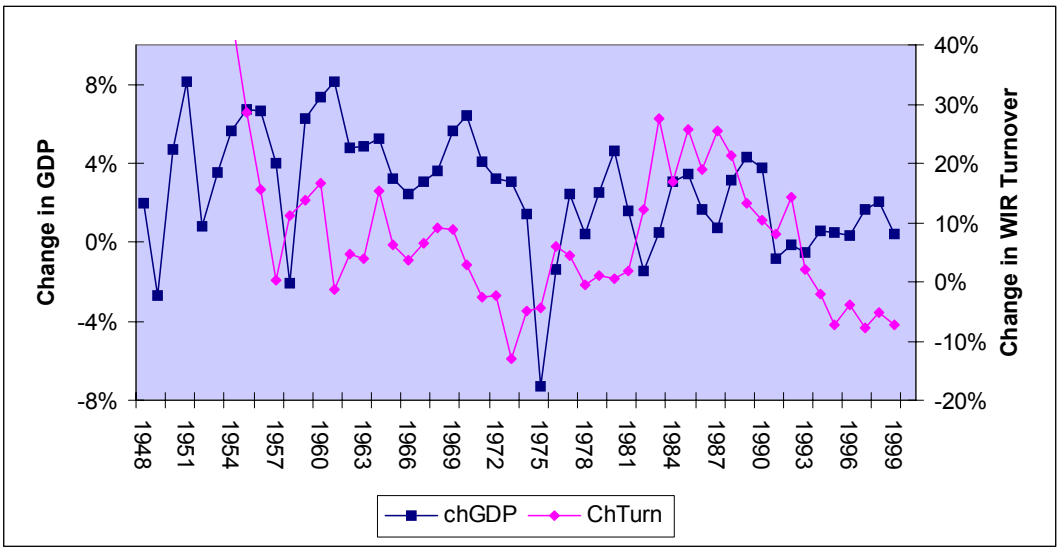

Figure 4: Change in Swiss GDP (left axis), and Change in Total WIR Turnover (right axis), both in 1990 Swiss Franks, 1948-99.

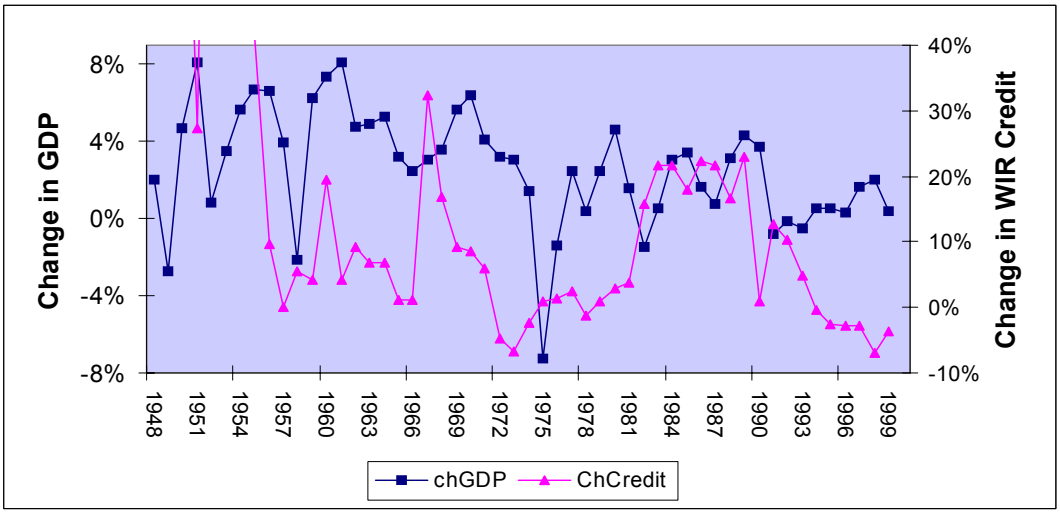

Figure 5: Change in Swiss GDP (left axis), and Change in Credits Advanced in WIR (right axis), both in 1990 Swiss Franks, 1948-99.

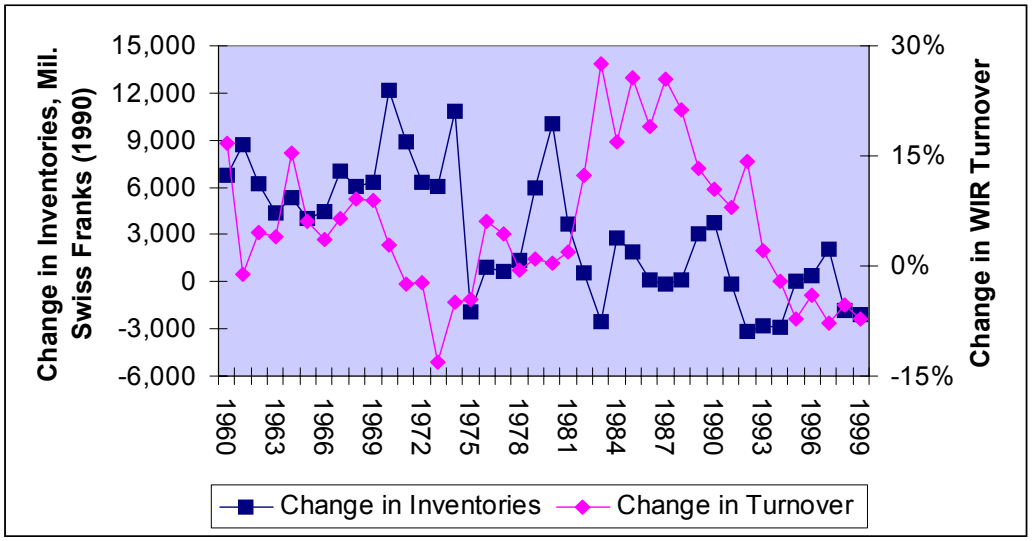

Figure 6: Change in Swiss Inventories, Millions of 1990 Swiss Franks (left axis), and Change in Annual Turnover in WIR (right axis), 1960-99.

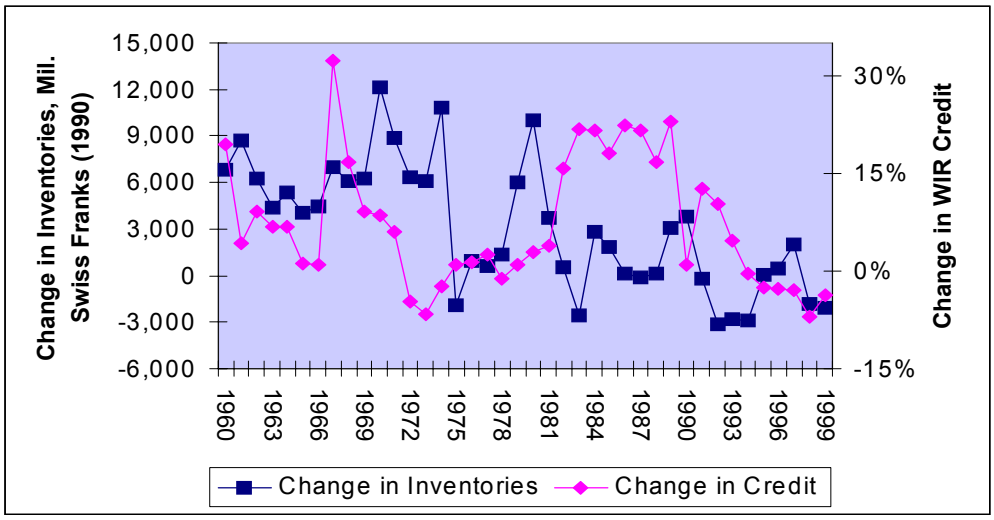

Figure 7: Change in Swiss Inventories, Millions of 1990 Swiss Franks (left axis), and Total Credits advanced in WIR (right axis), 1960-99.

In Table 4 below, Change in the number or WIR Participants is regressed against Change in Unemployment (in thousands, not as a percentage), Change in real GDP (in 1990 Swiss Franks), and Change in Real Inventories (also 1990 based.) The impression of an overwhelming correlation between membership and unemployment, seen in Figure 4, is confirmed. R-squared terms are relatively low, however, and the Durbin-Watson term is in the indeterminate region, so auto-correlation may be a problem.

Table 4: Participants in the WIR Barter Network, as Explained by Macroeconomic Variables 1960-1999
Dependent Variable: Change in Number of WIR Participants** (*t-stats in italics, * : p-value < 0.05, ^{o} : p <0.10)*

Equations	**[1]**	**[2]**	**[3]****
Variable			
Constant	**1381.46**	**1368.13**	**-9.011**
	1.299	1.291	-2.808*
Change Unemploy.	**19.299**	**20.280**	**0.0242**
	3.130*	3.088*	1.485 ^{o}
Change GDP		**0.01251**	**1.892**
		0.470	5.767*
Change Inventories	**-0.0674**	**-0.0824**	**-0.363**
	-1.992*	-1.761 ^{o}	-2.272*
Regression Method	*AR1*	*AR1*	*AR1*
R-squared	0.279	0.283	0.963
Adj. R-squared	0.240	0.223	0.960
Durbin-Watson Stat.	1.344	1.37051	0.627
Rho (auto-correlation)	**0.9163**	**0.915**	**0.986**
t-statistic of Rho	16.691*	16.251*	63.098*
Log likelihood	-318.006	-317.884	58.191
Number	40	40	36

** The natural log of the original variable, rather than its first difference, is given in [3].

Sources: OECD: "Historical Statistics" (1998), "Economic Surveys: Switzerland" (1999); IMF: "Economic Outlook" (2000); Madison (1995); and Mitchell (1998).

In Table 5, annual Real Turnover in WIR, again in 1990 Swiss Franks, is regressed against the same variables as in Table 4 above. Note that Turnover is correlated with Unemployment, and thus *counter-cyclical* to this extent -- just as Membership was in the previous table. However, we now find a positive correlation with GDP, and a negative correlation with Inventories -- and thus a *pro-cyclical* relationship with these variables. Most coefficients are significant, but the low R-squared and Durbin-Watson terms do not inspire confidence.

In Table 6, I regress Credit against a slightly different set of variables, here using Change in Gross Capital (which includes inventories) rather than the change in inventories itself. With decreased value of existing capital stock in a recession, this diminishes the counter-cyclical piling up of inventories. The regressions with high Durbin-Watson statistics [1] and [2], show low R-squares, and those with high R-squares, the log forms [3] and [4], show low Durbin-Watson statistics. Despite their plausible signs and significance of the coefficients, none of the regressions in Tables 4-6 are convincing, because of possible auto-correlation and low R-squared problems. In the final regressions, Table 7 below, these problems are partly resolved.

Table 5: Total Turnover in the WIR Barter Network, as Explained by Macroeconomic Variables 1960-1999
Dependent Variable: Change in Annual Turnover of WIR-Bank (*t-stats in italics, * : p-value < 0.05, ^{o} : p <0.10)*

Equations	**[1]**	**[2]**	**[3]****	**[4]****
Variable				
Constant	**1381.46**	**1368.13**	**-9.011**	**-38.792**
	1.299	1.291	-2.808*	-5.077*
Change Unemploy.	**19.299**	**20.280**	**0.0242**	**0.1068**
	3.130*	3.088*	1.485*	2.677*
Change GDP		**0.01251**	**1.892**	**3.594**
		0.470	5.767*	5.752*
Change Inventories	**-0.0674**	**-0.0824**	**-0.363**	
	-1.992*	-1.761 ^{o}	-2.272*	
Regression Method	*AR1*	*AR1*	*AR1*	*AR1*
R-squared	0.279	0.283	0.963	0.0417
Adj. R-squared	0.240	0.223	0.960	.261E-2
Durbin-Watson Stat.	1.344	1.37051	0.627	0.772
Rho (auto-correlation)	**0.9163**	**0.915**	**0.986**	**0.971**
t-statistic of Rho	16.691*	16.251*	63.098*	38.808*
Log likelihood	-318.006	-317.884	58.191	13.034
Number	40	40	36	52

** The natural log of the original variable, rather than its first difference, is given in [3], [4].

Sources: Same as Table 4.

Table 6: Credit Advanced in the WIR Barter Network, as Explained by Macroeconomic Variables 1960-1999
Dependent Variable: Change in Annual Credit Advanced by WIR-Bank (*t-stats in italics, * : p-value < 0.05, ^{o} : p <0.10)*

Equations	**[1]**	**[2]**	**[3]****	**[4]****
Variable				
Constant	**11.034**	**10.172**	**-1.112**	**--25.554**
	1.186	1.17157	-0.336	-4.578*
Change Unemploy.	**0.433**	**0.455**	**0.0692**	**0.0538**
	2.154*	2.373*	1.864 ^{o}	1.697 ^{o}
Change GDP	**-0.207**			**2.6536**
	-0.370			4.488*
Change Gross Cap.			**0.5734**	**-0.179**
			2.024*	-0.566
Regression Method	*AR1*	*AR1*	*AR1*	*AR1*
R-squared	0.103	0.101	0.281	0.690
Adj. R-squared	0.0662	0.0829	0.237	0.661
Durbin-Watson Stat.	2.490*	2.497*	0.592	0.818
Rho (auto-correlation)	0.6967	0.689	0.994	0.964
t-statistic of Rho	6.902*	6.82298	116.617	30.564*
Log likelihood	-224.595	-224.665	27.130	34.412
Number	51	51	36	36

** The natural log of the original variable, rather than its first difference, is given in [3], [4].

In Table 7, I use the ratio of Credit over total barter Turnover. This is motivated largely by trying to lessen the auto-correlation problems of the earlier regressions. Recall that while Credit was counter-cyclical, Turnover was pro-cyclical in all variables *except* Unemployment. Accordingly, and in contrast to the earlier regressions, I now find that the Unemployment term is not significant. The "Change in Inventories and Change in GDP, are highly significant in regression [2]. The Durbin-Watson statistic for this equation, however, indicates that the null hypothesis of first-order auto-correlation cannot be rejected at five percent.

Since the previous regressions show Credit as correlated with Inventories, while Turnover volume is correlated with GDP, the *ratio* of Credit to Turnover in Table 7, therefore, correlates *with* Inventories and *against* GDP. As in the IRTA regressions of Table 3, however, collinearity is evident between the GDP and Inventory terms. In both cases some functional relationship is likely, although not specified here.

Table 7: WIR Credit-Turnover Ratio, as Explained by Macroeconomic Variables 1948-1999
Dependent Variable: Annual *Ratio* of Credit to Turnover, (*t-stats in italics, * : p-value < 0.05, ^{o} : p <0.10)*

Equations / **Variable**	**[1]**	**[2]**	**[3]**	**[4]**
Constant	**1.86E-01**	**1.89E-01**	**1.92E-01**	**2.45E-01**
	*5.314**	*5.448**	*5.067**	*11.192**
Time	**4.66E-03**	**4.49E-03**	**4.34E-03**	**3.04E-03**
	*4.402**	*4.648**	*4.123**	*4.400**
Unemploy.	**-5.50E-05**			
	-0.384			
Change GDP	**-1.53E-06**	**-1.52E-06**		**-8.73E-07**
	*-2.633**	*-2.659**		*-1.767^{o}*
Chnge Invnt.	**2.23E-06**	**2.23E-06**	**3.63E-07**	
	*2.089**	*2.129**	*0.434*	
Regress.Mthd	*AR1*	*AR1*	*AR1*	*AR1*
R-squared	0.457	0.419	0.343	0.568
Adj.R-squrd	0.394	0.396	0.307	0.550
Durb.-Watson	2.069*	1.664	2.229*	2.413*
Rho	0.832	0.983	0.846	0.788
t-stat. of Rho	9.788*	65.533*	10.709*	9.057*
Log liklhood	-111.74	-416.85	-108.08	-132.53
Number	40	40	40	52

Sources: Same as Table 4.

V. Conclusions and Implications

The Swiss results are less persuasive than the US, perhaps due to the poorer coverage of its national data (Maddison 1995, p. 135) -- as opposed to its barter exchange data. Nevertheless, there is substantial evidence for the general form of our

hypothesis, that centralized barter exchange is counter-cyclical. There remains the vital question, however, as to why this counter-cyclicity occurs. A basic difference of opinion exists within macroeconomic theory as to whether instability is more due to price rigidity, or to inappropriate levels of money and credit. Keynes (1936) recognized that both conditions can and do apply, and that either can lead to instability.

The reigning macroeconomic consensus, as represented by Mankiw (1993), puts the blame more on rigid prices; economists like Colander (1996) stress monetary and credit conditions. Reflecting the "sticky price" consensus of macroeconomics, most commentary on the impact of e-commerce has concentrated on prices, as we have seen. But if a barter exchange's members charge prices that do not diverge significantly from its cash prices -- those charged to their non-members -- then counter-cyclicity may derive from barter's ability to create credit.

The two barter exchanges studied here have different pricing practices. The North American IRTA is likely to benefit its participants through greater price flexibility, and price discrimination through under-the-table "discounts" off the list price (Magenheim and Murrell 1988). The IRTA is a loose affiliation of "barter middle-men," not a nationally centralized exchange like the WIR-bank. The totality of the IRTA barter exchanges is far smaller than WIR, both absolutely and relative to its national economies (principally the US and Canada).

The Swiss WIR activities are more public and centralized, more subject to the scrutiny of other customers, and so less likely to allow confidential discounts. Also, prices for goods and services in the WIR magazine are regularly quoted in WIR-credit prices that are *higher* than their equivalent in Swiss Francs, so this is not downward price flexibility. Lower prices on barter than cash would tend to divert trade to the former, and this is undesirable for most businesses – living within a cash economy, cash is almost always better than exchange credits (Healey 1996).[3]

The possibility remains that barter may have forced greater flexibility in network members' cash prices. But since WIR's bylaws restrict membership to small and medium businesses (Defila 1994), members will usually have comparatively little price-setting power. Thus, the counter-cyclical history of WIR is likely more due to its credit creation than to added price flexibility. Inventory flexibility, however, could also be a factor, even before wide-scale use of computers. The IRTA's counter-cyclical path probably derives from all three causes, with effects more closely balanced. If these network exchanges are indeed counter-cyclical, this is emphatically *not* the case for all "network economies". Telecommunications networks are

highly subject to increasing returns to scale, unlike older industries – and unlike neoclassical theory (Romer 1997, Howitt and Phillipe 1998, Arthur 1996). Such industries are therefore likely, especially as their importance to the economy increases, to fuel greater *pro-cyclical* instability.

Reciprocal exchange networks like those studied here also have increasing returns and "network externalities," yet they appear strongly counter-cyclical. It is not too soon to begin trying to understand why. To quote Mervyn King (1999), now Governor of the Bank of England, electronic exchange may build a world in which "central banks in their present form would no longer exist; nor would money….The successors to Bill Gates could put the successors to Alan Greenspan out of business."

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[3] WIR credits themselves cannot be exchanged for cash at a discount, a decision historian Defila (1994) sees as crucial for the organization. (Note however, that the ability to charge lower prices in cash than in WIR-credits is nearly equivalent.)

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