<u>The Macro-Stability of Swiss WIR-Bank Spending: Balance, Velocity and Leverage</u>[1] (April, 2012)

James Stodder, Rensselaer Polytechnic Institute, Hartford, CT, USA; stoddj@rpi.edu; (860) 548-7860
Bernard Lietaer, Center for Sustainable Resources, Univ. California-Berkeley, bernard@lietaer.com

Abstract: Since 1934 the Swiss Wirtschaftsring ("Economic Circle") or WIR-Bank has issued its own reciprocal credits, not backed by Swiss Francs. Turnover in WIR-credits is shown to be highly counter-cyclical: firms are cash-short in a recession, and economize by greater use of WIR. A money-in-the-production-function (MIPF) model implies that this new spending arises mainly through increased credit *Balances* for larger firms, and increased credit *Velocity* for smaller ones. Panel data by industrial sector confirms this general pattern of WIR credits, a role similar to that of commercial trade credits, an important source of non-bank credit. The countercyclical multiplier on WIR expenditures will be highly leveraged. *JEL Codes*: E51, G21, P13.

I. Introduction

The Swiss *Wirtschaftsring* (*Cercle Économique*) or "Economic Circle," founded in 1934, is referred to nowadays as the WIR-bank. Those studying reciprocal payment mechanisms generally refer to this as a "social," "community," or "complementary" *currency*. But the WIR is really a centralized credit system for multilateral exchange, with no physical currency.

In a recent paper, Stodder (2009) showed that from 1948 to 2003, WIR bank transactions were highly countercyclical. This stabilizing effect should be of interest for monetary policy. After all, if a secondary currency can be an effective financial stabilizer, then standard monetary policy is not optimal. But what is the mechanism of this stabilizing effect? Stodder (2009) considered the role of bank *Balances* in generating the clear countercyclical pattern of WIR *Turnover* (= Balances *times* Velocity), but lacked adequate data to separate out Balances and Velocity for tests.

With a new disaggregated data set, we can now show that WIR Balances and Velocity are *both* countercyclical drivers, but for different kinds of businesses. Larger Non-Registered (non-member) firms are free to accept as much or as little WIR-currency as they wish, and are most likely to do so when other forms of payment are in short supply – during a recession. Thus WIR-Balances for Non-Registered firms increase, while for smaller Registered firms, balances decline in a recession. Turnover

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for both the Registered and Non-Registered is countercyclical, but driven by countercyclical Velocities for Registered firms, and countercyclical Balances for the Non-Registered.

II. The WIR-Bank Exchange System: Reciprocal Trade Credits

There are hundreds of alternative-currency examples in existence today, as described in the literature on Local Exchange and Trading Systems, or LETS (Williams, 1996; Greco, 2001; Jayaraman and Oak, 2005; Kichiji and Nishibe, 2008; Gomez, 2008). The Swiss WIR-Bank is the largest such system, with over 70,000 customers throughout the country, mostly firms, with membership limited by WIR by-laws to Small and Medium Enterprises (SMEs) (Studer, 1998; Stodder, 2009).

Founded in 1934 (Studer, 1998, p. 14), the Swiss WIR-Bank or *Wirtschaftsring* ("Economic Circle") is also the oldest surviving exchange system based solely on a private or 'club' form of money. The recent finding by Stodder (2009) that WIR activity is countercyclical was based on data from 1948 to 2003. More recent data does not change that conclusion.

Table 2 below (using notation in Table 1) shows the null of no cointegration rejected at 5 and 10 percent in the two specifications, so a positive association between WIR Turnover and GDP is relatively stable from 1952 through 2008. What is important for our countercyclical hypothesis is the negative and significant countercyclical sign in the Vector Error Correction portion of the model, for the one period lagged first-differenced GDP terms, (highlighted for convenience). Tests of serial correlation and Granger causality (changes in GDP effecting changes in Turnover) also show encouraging results.

Table 1: Notation for Tables 2, 4-6

LrWirTURN(-t)	Natural Log of Real WIR **TURNOVER**, lagged t period(s)
LrWirBAL(-t)	Natural Log of Real WIR **BALANCES**, lagged t period(s)
LUE(-t)	Natural Log of Number of **UNEMPLOYED**, lagged t period(s)
LrGDP(-t)	Natural Log of Real **GDP**, lagged t period(s)
LrGDPAV2(-t)	Natural Log of Real **GDP**, **Averaged** 2 periods, lagged t period(s)
Cointegrating_Equation_RES(-1)	Residual of the Previous Cointegrating Equation, lagged 1 period
D( )	First Difference of any of the previous variables

We should also note the link between Employment and WIR activity. Previous estimates (Stodder, 2009) have shown this cyclical indicator to be even more closely tied to WIR. Employees in smaller, less diversified firms are more subject to unemployment risk in Switzerland (Winter-Ebmer and Zweimüller, 1999; Winter-Ebmer, 2001), as in most other countries. Smaller firms also have less access

Table 2: Change in Turnover in the WIR Exchange Network, as Explained by GDP, 1952-2008 †

*t-statistics in [ ]; ***: p-val < 0.01, ** : p-val < 0.05, *: p-val <0.10, °: p-val <0.15*

	Column **(1)** 1952-2008 N=57	Column **(2)** ‡ 1953-2008 N=56
Cointegrating Equation	**Dependent Variable**: LrWirTurn(-1)	
LrGDP(-1) ‡	-3.0685 [-6.551]***	-4.0548 [-4.911]***
Constant	-10.8162	-16.3450
Independent Variables:	**Dependent Variable**: D(LrWirTurn)	
Cointegrating Equation_RES	-0.0285 [-1.536]°	-0.0033 [-0.235]
D(LrWirTurn(-1))	0.7002 [5.386]***	0.6569 [5.204]***
D(LrWirTurn(-2))	0.4190 [2.705]***	0.4067 [2.699]***
D(LrWirTurn(-3))	-0.2700 [-2.214]**	-0.3041 [-2.463]**
D(LrGDP(-1)) ‡	**-0.9444 [-2.760]*** **	**-1.7499 [-3.176]*** **
D(LrGDP(-2)) ‡	0.6822 [1.808]*	2.3109 [3.431]***
D(LrGDP(-3)) ‡	0.4238 [1.317]	-0.5128 [-0.984]
Constant	-0.0027 [-0.199]	-0.5128 [0.312]
R-squared	0.8562	0.8203
Adjusted R-squared	0.8356	0.7941
F-statistic	41.6637	31.3015
Log likelihood	89.3266	89.3452
Akaike AIC	-2.8536	-2.9052
Schwarz SC	-2.5668	-2.6158
(a) Johansen P-Values (*)	0.0438	0.0904
(b) Serial LM P-Value (*)	0.2069	0.2041
(c) Granger P-Value (*)	0.0041	0.0008

(‡) For Column (2), substitute the 2-year moving average terms for LrGDP(-t), and D(LrGDP(-t)). Thus the GDP variables in this column are LrGDPma2(-t), and D(LrGDPma2(-t)).

(*) **Note:** P-values (a-c) are for the null hypotheses of (a) No Cointegration, (b) No Serial Correlation, and (c) No Granger Causality. For (a), the p-value reported is always the *higher* of the Johansen trace and eigenvalue tests. For (b), the Lagrange Multiplier p-value is for the number of lags in this ECM. For (c), the Granger Causality/Block Exogeneity Wald test, the p-value is for a Chi-squared on the joint significance of all lagged endogenous variables in the VAR portion of the regression, *except* the error correction term.

to formal credit institutions (Terra, 2003), and their owners must rely disproportionately on self-financing (Small Business Administration, 1998) and, as we have seen, on trade credits supplied by larger firms (Nilsen, 2002; Petersen and Rajan, 1997).

According to WIR-Bank statistician Stafan Winkler (2010), its clients form a significant part of the Swiss total in several industrial sectors, as Table 3 below makes clear. (Data are for 2005, the last year for which nation-wide totals were available.) Notice that the number of Non-Registered Clients is two to three times that of Registered Clients in every sector except Hospitality. According to Winkler (2010), the Non-Registered group includes some very large corporations. WIR-Bank cannot list the names of these Non-Registered companies, due to Swiss banking secrecy laws (Winkler, 2010). Furthermore, the largest firms *cannot* be registered: under WIR by-laws passed in 1972, only SMEs may be registered as members (Stodder, 2009). Registered firms are obligated to accept WIR as payment for

Table 3: WIR-Client Enterprises, by Sector, 2005

Industry	All Swiss	All WIR	Portion WIR/Swiss	(1,000 SFr) Turnover	(1,000 SFr) Balance	(Swiss Fr.) Av. Bal.	Turn/Balance = Velocity
RETAIL, of which	62,380	14,275	22.9%	345,757	127,100	8,904	2.720
Registered		5,933	9.5%	223,822	64,958	10,949	3.446
Non-Registered		8,342	13.4%	121,935	62,142	7,449	1.962
SERVICES, of which	164,709	10,380	6.3%	213,515	88,788	8,554	2.405
Registered		3,817	2.3%	112,186	30,745	8,055	3.649
Non-Registered		6,563	4.0%	101,329	58,044	8,844	1.746
HOSPITALITY, of which	28,006	3,438	12.3%	73,021	22,416	6,520	3.257
Registered		2,099	7.5%	61,872	16,156	7,697	3.830
Non-Registered		1,339	4.8%	11,148	6,261	4,676	1.781
CONSTRUCTION, of which	57,268	21,162	37.0%	527,619	210,477	9,946	2.507
Registered		6,992	12.2%	280,169	82,462	11,794	3.398
Non-Registered		14,170	24.7%	247,450	128,015	9,034	1.933
MANUFACTURING, of which	38,421	7,310	19.0%	230,196	101,884	13,938	2.259
Registered		1,820	4.7%	87,418	26,092	14,336	3.350
Non-Registered		5,490	14.3%	142,778	75,792	13,805	1.884
WHOLESALE, of which	21,762	4,138	19.0%	223,631	73,787	17,832	3.031
Registered		1,027	4.7%	80,371	15,462	15,056	5.198
Non-Registered		3,111	14.3%	143,260	58,325	18,748	2.456
TOTALS, of which	372,546	60,703	16.3%	1,613,739	624,452	10,287	2.584
Registered		21,688	5.8%	845,838	235,874	10,876	3.586
Non-Registered		39,015	10.5%	767,901	388,578	9,960	1.976

Source: WIR Panel Data, 2010

at least 30 percent of their first 2,000 SFr on a customer's bill (Studer, 1989, p. 33). We will explore the implications of this Registered/Non-Registered difference.

A note on household versus enterprise membership: The total of WIR Client Enterprises shown above (60,703) is 81 percent of total for WIR customers that year (74,732), as shown in the annual *Rapport de Gestion* (2005). The remainder are household memberships (Winkler, 2010).

Note that while Total Balances of Non-Registered Client Enterprises in Table 3 are well above those of Registered Clients in all industries except Retail and Hospitality, the Turnover for both groups is quite similar. This is because the Velocity (= Turnover/Balance) at which Balances circulate is offsetting, and always higher for Registered Clients. As we will see in the econometric section below, this dominance of Velocity (Balance) effects in the Turnover of Registered (Non-Registered) firms is consistent with their countercyclical activity: The countercyclical turnover of Registered firms will be seen to be driven by changes in Velocity, and that of Non-Registered firms by changes in Balances.

Following the argument of Studer (1988) about self-financing trade, WIR-money can be seen as a form of reciprocal trade-credit, an extension of the trade credits widely used between firms (Greco 2001, p. 68; Stodder, 2009). Trade credits are traditionally advanced by larger firms to smaller customer and distributor firms, especially during recessions (Nilsen, 2002). In the US, for example, trade credits are commonly given by a seller on terms of "2% 10, net 30," whereby the buyer gets a 2% discount by repaying within 10 days, with full settlement due in 30 days (Nilsen, 2002). The main use of demand deposits for most businesses, according to Clower and Howitt (1996, pp. 26-28), is to clear such trade credits. By accepting delayed payment from a smaller firm via a trade credit, the larger firm thereby accumulates a credit in its accounts receivable.

In a Philadelphia Fed publication, Mitchel Berlin (2003) notes that there has been little macroeconomic study of trade credits, despite their role as the principle form of short-term credit for SMEs. Nonetheless, Petersen and Rajan (1994, 1997) find that between 11 and 17 percent of large-firm assets in each of the G7 countries is dedicated to accounts payable, and between 13 and 29 percent of their accounts receivable – a measure of trade credits. Since accounts receivables exceed accounts payable for most large firms – this is in effect an extension of trade credit. Reciprocally, *receiving* trade credits is more important for smaller firms, in their role as customers or distributors.

Nilsen (2002) finds that use of trade credits is countercyclical for Small to Medium Enterprises (SMEs). SMEs are more likely to be credit-rationed by banks when money is tight, leaving trade credits as their only form of credit. This is consistent with the finding of the present paper: WIR Turnover among Registered clients – restricted to SMEs by WIR's constitution (Defila, 1994) – is also countercyclical, and driven by changes in Velocity. Larger Non-Registered WIR clients show an offsetting form of this countercyclicity, by holding larger WIR Balances for their smaller Registered customers.

All types of goods and services are exchanged for WIR – construction, hotel stays, restaurant meals, used vehicles, legal services – with offerings posted online and in publications like WIR-Plus (2009). Prices are quoted in both Swiss Francs (SFr) and units of WIR, and often a mix of the two, with a maximum percent of payment accepted in WIR. For ease of comparison, WIR prices are denominated in the same units as SFr. The WIR-Bank keeps tabs on each customer in terms of her account in WIR credits or debits. From the individual's point of view, an account in WIR is much like an ordinary checking account with clearing Balances and limits on how large a negative Balance can be run. (WIR-Bank is a registered Swiss bank, and so also provides ordinary banking services in SFr.)

Non-Registered clients are not subject to the organization's by-laws and thus are not obliged to accept a minimum share of payment (30%) in WIR (Studer, 1989, p. 33), as are Registered clients. Thus the Non-Registered can be flexible in extending the privilege of WIR-settlement only to their most favored customers and clients, and to extend more credit in this form when it is most needed, during economic downturns. This could explain much of the countercyclical variability in Non-Registered accounts, and would perform a role quite similar to that of trade credits. If the relationship between Non-Registered and Registered firms is predominantly that of suppliers to customers/distributors, respectively, we would expect to see increased WIR turnover during a recession driven by increased Balances for the former, and increased Velocities for the latter. We will see these patterns in the data.

Yet we must note here two crucial differences between ordinary trade credits and WIR-credits. First, unlike an ordinary trade credit payable in Swiss Francs, a payment in WIR is itself final payment. As long as the WIR-Bank functions, a firm getting WIR for its product sold will never see its check "bounce." Second, the WIR-bank is a system of multilateral, not bilateral exchange. That is, a WIR-creditor's value is ensured, not by the debtor's ultimate willingness to settle in cash, but by the immediate willingness of thousands of other firms and households to accept WIR-money as final payment. To repeat Studer's formulation (1998, p. 32), "every franc of WIR credit automatically and immediately becomes a franc of WIR payment medium."

Since every WIR-credit is matched by an equal and opposite debit, the system as a whole must net to zero. Individual traders will have either positive or negative Balances ("overdrafts"), the latter, in effect, a loan from the WIR-Bank. Short-term overdrafts are interest-free, with limits "individually established" (Studer, 1998, p. 31). As long as the average value of these limits is maintained, the WIR-Bank can be quite relaxed about variations in its total bank *Balances*. The system is also highly flexible: the absolute value of all WIR credits and debits is determined only by economic activity – there is no monetary *base*. The *net* of this total, meanwhile, is identically zero.[2]

A second difference with trade credits is that WIR-exchange is centralized, combining the functions of a commercial bank and a central bank for its own currency. It will thus have more detailed knowledge of credit conditions in its own currency than either a commercial or a central bank alone. Of course it can still make mistakes, extending too much in overdrafts or in direct loans. Such credit "inflation" has occurred in WIR's history (Defila, 1994; Stutz, 1984; Studer, 1998), but now appears contained by sensible overdraft limits.

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[2] This balanced flexibility of an "automatic plus-minus balance of the system as a whole" (Studer 1998, p. 31) is also shown in a pedagogical experiment by LETS founder Michael Linton and IT specialist Eric Harris-Braun (2007), available at www.openmoney.org/letsplay/index.html. In this experiment, balances typically increase in the alternative currency as traders gain confidence in the system and are able to liquidate more of their unsold inventories.

The WIR was inspired by the ideas of an early 20th-century German-Argentine economist, Silvio Gesell (Defila 1994, Studer 1998) [3]. Keynes devoted a section of his General Theory to Gesell, (1936; Chapter 23, Part VI), whom he saw as an "unduly neglected prophet," anticipating some of his own ideas on why the interest rate might exceed the marginal efficiency of capital.[4] Although the intellectual linkage of Keynesian and Gesellian *ideas* has received substantial attention (Dillard (1942), Allais (1947), Klein (1980)), Gesellian *institutions* like the WIR-Bank have not.[5] Only two economists, Studer (1998) and Stodder (2009), seem to have investigated WIR's macroeconomic impact.

III. Some Formalization: Money in the Production Function

In Stodder (2009), we formalize the interaction of WIR-money and national currency via a "money in the production function" (MIPF) specification. This is directly analogous to "money in the utility function" (MIUF), and similarly derived by the implicit function theorem. Both MIPF and MIUF are justified by the transactions-cost-saving role money plays, moving the economy closer to its efficiency frontier. There is a substantial literature on this idea (Patinkin, 1956; Sidrauski, 1967; Fischer, 1974, 1979; Short, 1979; Finnerty, 1980; Feenstra, 1986; Hasan and Mahmud, 1993; Handa, 2000; Rösl, 2006).

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3 Gesell would have been familiar with trade credits from his decades of international trade experience in the port of Buenos Aires. Gesell's use of the term *demurrage* was borrowed directly from international shipping, where it denotes a reduction in payment to compensate for an unscheduled delay in the delivery of goods. Similarly, Gesell applied a *demurrage* charge to the holding of currency balances, with the aim of increasing velocity.

Most trade credits provide discounts for early payment (Nilsen 2002, Berlin 2003), rather than fines for paying late, but the opportunity cost is the same. A form of bank-mediated trade credit particularly common in international trade is the banker's acceptance, which allows the exporter to be paid upon embarkation, while the importer does not have to pay until taking possession of the goods. Credits from the WIR-bank can be seen to extend the banker's acceptance principle from short-term to medium-term, and from bilateral to multilateral credit.

4 Keynes notes (1936, p. 355) that "Professor Irving Fisher, alone amongst academic economists, has recognised [this] significance," and makes a prediction that "the future will learn more from the spirit of Gesell than from that of Marx."

5 Gerhard Rösl of the German Bundesbank (2006) does look at Gesellian currencies – with zero interest rates and explicit holding costs. For these Rösl uses the term *Schwundgeld*, or 'melting currency,' instead of *demurrage*. Such currencies have grown in popularity in low inflation environments like the Euro area (as Rösl documents), and especially in explicitly deflationary environments like Argentina in the late 1990s or the US in the 1930s. Rösl's criticisms of *demurrage* do not apply to the Swiss WIR since (a) the WIR stopped charging demurrage in 1948, and (b) has long charged interest on large overdrafts and commercial loans (based on one's credit history), (Studer 1998, pp. 16, 31). (Interestingly, Rösl uses a "money in the production function" (MIPF) formalization, as in the current paper.)

We formalize the basic result by showing a profit-maximizing firm as minimizing both its direct and transactional costs subject to the constraint of producing quantity, $\overline{Q}$, exogenously determined by the market:

$$\text{Min:} \quad c_pK_p + c_sK_s + r_pm_p + r_sm_s \tag{1}$$

$$\text{s.t.:} \quad \overline{Q} = \overline{Q}_p + \overline{Q}_s \le f(K_p, m_p, K_s, m_s) = f_p[(K_p, \overline{K}_s), m_p] + f_s[(\overline{K}_p, K_s), m_s].$$

Here the *primary* national and *secondary* social currency, m_p and m_s, show interest rates/opportunity costs of r_p and r_s, are used to pay the market costs, c_p and c_s, of purchasing the required inputs, K_p and K_s, respectively. Capital inputs are assumed divisible and K_p and K_s perfect substitutes. Subscripts account only for their means of purchase, since most purchases are for a mix of WIR and SFr (Studer, 1989, p. 33). In the production/transaction functions $\overline{Q}_p = f_p[(K_p, \overline{K}_s), m_p]$ and $\overline{Q}_s = f_s[(\overline{K}_p, K_s), m_s]$, the bars indicate that the output quanties $\overline{Q}_p$ and $\overline{Q}_s$ are set exogenously, while the input quantities $\overline{K}_p$ and $\overline{K}_s$ are set *separately*, in the sense that $\overline{K}_s$ is not a variable within f_p[ ], nor is $\overline{K}_p$ within f_s[ ]. The Marginal Rates of Substitution (MRS) derevied from (1) show that inventories of money and physical inputs can be substitutes.

It is assumed that $r_p > r_s$ and $c_p \le c_s$. The first inequality arises because primary currency is more useful than secondary, and must thus have a higher opportunity cost. This is recognized by Studer (1998, p. 31), who states it as a basic fact about WIR commerce.[6] The second arises from the same facts: given the unequal usefulness of WIR money, items for sale are often posted at WIR prices higher than their equivalent price in SFr. (Stodder, 2009).

<u>Lemma 1</u>: *For a cost minimizing firm, the marginal productivity of K_s is at least as great as that for K_p, but that of m_s is less than m_p.*

<u>Proof</u>: Using the above inequalities, first order conditions of (1) yield

$$(c_s/c_p) = (\partial f/\partial K_s)/(\partial f/\partial K_p) \ge 1 > (r_s/r_p) = (\partial f/\partial m_s)/(\partial f/\partial m_p). \tag{2}$$

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6 "Since the WIR Bank operates in competition with conventional credit banks and a WIR loan is less universally useful than a cash loan, the cost of WIR credit must in any case be kept lower than normal interest rates."

If smaller Registered clients face more restricted credit conditions than larger Non-Registered clients (that is, a higher interest rate on primary money, r_p), then larger holdings of m_s/m_p Balances for these Registered clients are optimal. In the following, we consider Registered (R) and Non-Registered (NR) firms:

<u>Lemma 2</u>: If firm R is more credit constrained than firm NR for primary currency, $r_p^R > r_p^{NR}$*, and yet their access to the secondary currency is equal,* $r_s^R = r_s^{NR}$*, then firm R's holdings of the secondary currency will be relatively larger:* $m_s^R/m_p^R > m_s^{NR}/m_p^{NR}$.

<u>Proof</u>: The ratio r_s^R/r_p^R must be lower for the credit-constrained firm R than r_s^{NR}/r_p^{NR} is for NR. It follows that the ratio of firm R's marginal product of secondary to primary currency, $(\partial f/\partial m_s^R)/(\partial f/\partial m_p^R)$, must also be lower, by the first order conditions of Lemma 1. Since the production/transformation function f( ) is the same for each firm, R must hold a larger ratio of secondary to primary currency than NR.

Table 3 shows that Registered firms do in fact have larger *average* Balances of WIR than the Non-Registered. If the average size of Registered firms is also less than Non-Registered (Winkler, 2010), then they must have larger *relative* Balances of WIR to SFr., as in Lemma 2.

Smaller Registered clients may be quite limited in their access to credit for primary currency (Winter-Ebmer and Zweimüller, 1999). And in a recession, SMEs may lose credit altogether (Wan *et. al.,* 2011). As with the increased use of supplier-provided trade credits by SMEs during a recession (Nilsen, 2002), a larger share of WIR currency can be accepted by larger Non-Registered firms in a recession, helping Registered SMEs conserve thier badly needed cash.

Note that Non-Registered firms show overall WIR Turnover levels only slightly below that of Registered firms (Table 3). This relation can be shown to hold for the 15 years of our sample. Larger Non-Registered firms are likely to limit their WIR activity mostly to smaller Registered firms, and this rough parity of turnover may reflect a basic reciprocity. This idea is formalized in the next Lemma. We will show that increased acceptance of WIR means-of-payment by the Non-Registered firm has the effect of not only i) increasing its own WIR Balances, but also ii) increasing the average WIR Velocity among the Registerd firms:

<u>Lemma 3</u>: *If (i) Non-Registered firms accept secondary currency only from Registered firms, (ii) Non-Registered firms hold greater secondary balances and hold them longer during a recession, and (iii) secondary Turnover is countercyclical for both Non-Registered and Registered firms, it follows that: The Output Elasticity of Balances will <u>drive</u> Turnover for Non-Registered firms (i.e., be more negative than the Elasticity of Velocities), while the Elasticity of Velocities will drive Turnover for Registered firms (i.e., be more negative than the Elasticity of Balances).*

<u>Proof</u>: If Non-Registered businesses allow Registered customers to settle more of their bills in secondary currency during a recession, then the Balances of Non-Registered firms are countercyclical, and those of the Registered procyclical: $B_Q^{NR} < 0 < B_Q^R$. (The outupt (Q) elasticity of Balances for Non-Registered firms (NR) is less than zero, and that for Registered firms (R) is greater than zero.) The Output Elasticity of Turnover (T_Q^R) is countercyclical for both firms, so the sum of the other two elasticities is negative: $T_Q^R = V_Q^R + B_Q^R < 0$. We have $0 < B_Q^R$, and thus

$$V_Q^R < 0 < B_Q^R. \quad (3)$$

Secondary currency balances are held longer by Non-Registered firms in a recession, $0 < V_Q^{NR}$. We have $B_Q^{NR} < 0$, and so

$$B_Q^{NR} < 0 < V_Q^{NR}. \quad (4)$$

The implication is that countercyclical Turnover is driven by Velocities for Registered firms (3), and by Balances for Non-Registered ones (4).

III. Econometric Tests

Stodder (2009) uses Vector Error Correction (VEC) models as a natural way of checking both the stability and countercyclical nature of WIR expenditures. If these are growing (falling) as GDP rises, then the long-term relationship between them – as shown by coefficients in the Error Correction (EC) equation – should be *positive (negative)*. If WIR activity is also *countercyclical*, then the correlation between *changes* in GDP or Employment on the one hand, and *changes* in WIR activity on the other, will be *negative* – as shown in the Vector Auto Regression (VAR) portion of the VEC. This is a relation between short-term or "cyclical" deviations, as opposed to long-term "secular" growth.

Instead of regressing measures of overall WIR activity against Swiss GDP, as in Table 2 above, in Table 4 we regress WIR activity against *sectoral* contributions to GDP; i.e., Value Added. Because our new sectoral time series is short, 15 years, we are not so concerned about the "long-term" secular relationship – the error-correction portion of the VEC. As long as this relationship is cointegrated, we can concentrate on the coefficients of the *lagged, first-differenced values* of these terms – the vector portion of the ECM, where countercyclical effects should show up.

In Table 4 it is seen that the coefficients on first-differenced Value Added averages (**highlighted** for convenience) have the expected countercyclical sign (negative) at the one year lag for the Turnover of both Registered (column 1) and Non-Registered (column 2) Firms. Note that the sign on these coefficients is negative and significant for the one year lag, but positive but insignificant when the differences are lagged for two years. We will discuss columns (3) and (4) in a moment.

The overall regression results in Table 4 are encouraging, with the exception of the p-values on the Wooldridge null hypothesis of no first-order auto-regression. This null must be rejected, so there is almost certainly a problem of serial correlation. Things may not be quite as bad as they seem, however. Note that in Table 4 we are using White (1980) period estimators, robust to within-cross-section serial correlation (Arellano, 1982). This means that our coefficient estimates are unbiased, although not efficient; i.e., they do not have standard errors as small as possible. Thus, despite serial correlation, these coefficient estimates are more significant than they appear. Thus we can be fairly confident about their signs and orders of magnitude.

The coefficients on Velocities for Registered firms (column 3), and on Balances for the Non-Registered (column 4) are significant and have the expected (negative) countercyclical sign. Given the log-log form, these coefficients are the elasticities of the original variables.

Table 4: Registered and Non-Registered WIR Clients:
Log of Real <u>WIR Turnover</u>, <u>Velocities</u> and <u>Balances</u> Regressed on Log of Real <u>Value Added by Industrial Sector</u>, 2 Year Moving Average (LrVAma2)

*t-statistics in [ ]; ***: p-val ≤ 0.01, ** : p-val ≤ 0.05, *: p-val ≤ 0.10, °: p-val ≤ 0.15*

Method: Vector Error Correction Model, Panel Data, Fixed Effects White cross-section (no d.f. correction)				
	Sample (adjusted): 1997 2008 Periods: 12, Cross-sections: 6		Sample (adjusted): 1997 2008 Periods: 12, Cross-sections: 6	
COINTEGRATING EQUATION	Column **(1)** **Dependent Variable:** **LrWir<u>TURN(-1)</u> (Reg)**	Column **(2)** **Dependent Variable:** **LrWir<u>TURN(-1)</u> (Non-Reg)**	Column **(3)** **Dependent Variable:** **LrWir<u>VEL(-1)</u> (Reg)**	Column **(4)** **Dependent Variable:** **LrWir<u>BAL(-1)</u> (Non-Reg)**
<u>Variable</u>	**<u>Coefficient</u>**	**<u>Coefficient</u>**	**<u>Coefficient</u>**	**<u>Coefficient</u>**
Constant	17.2680	5.1133	8.4337	15.3105
	[9.481] ***	[2.610] **	[3.704] ***	[9.019] ***
LrVAma2	-0.5346	1.0608	-0.6849	-0.4393
	[-3.012] ***	[3.289] ***	[-3.108] ***	[-2.654] ***

VECTOR ERROR-CORECTION EQUATION	**Dependent Variable: D(LrWir<u>TURN)</u> (Reg)**	**Dependent Variable: D(LrWir<u>TURN)</u> (Non-Reg)**	**Dependent Variable: D(LrWir<u>VEL)</u> (Reg)**	**Dependent Variable: D(LrWir<u>BAL)</u> (Non-Reg)**
<u>Variable</u>	**<u>Coefficient</u>**	**<u>Coefficient</u>**	**<u>Coefficient</u>**	**<u>Coefficient</u>**
Cointeg_Equa_RES(-1)	-0.2302	-0.1299	-0.8373	-0.4810
	[-2.696] **	[-1.194]	[-3.453] ***	[-3.098] ***
D(Dependent Var. (-1))	-0.2368	-0.5320	-0.8288	-0.5045
	[-5.215]	[-4.774] ***	[-4.148] ***	[-4.203] ***
D(Dependent Var. (-2))	-0.2457	-0.0460	-0.0305	0.0874
	[-3.796] ***	[-2.109] **	[-0.248]	[0.5483]
D(LrVAma2(-1))	**-1.5008**	**-0.4542**	**-2.8905**	**-0.8767**
	[-1.717] o	**[-1.504] o**	**[-4.543] *****	**[-2.244] ****
D(LrVAma2(-2))	1.7359	1.1678	0.2643	0.9400
	[1.839] o	[3.0462] ***	[0.518]	[1.9958] *
Constant	-0.0315	-0.0659	-0.0044	-0.0124
	[-13.817] ***	[-15.539] ***	[-0.171]	[-6.0667] ***
R-squared	0.3016	0.4306	0.4278	0.5163
Adjusted R-squared	0.1871	0.3373	0.3238	0.4284
S.E. of regression	0.0960	0.0788	0.1455	0.1136
Sum squared resid	0.5619	0.3789	1.1640	0.7095
Log likelihood	72.5451	86.7292	39.5960	55.9361
F-statistic	2.6347	4.6135	4.1127	5.8708
Mean dependent var	-0.0197	-0.0409	-0.0077	-0.0108
S.D. dependent var	0.1065	0.0968	0.1769	0.1502
Akaike info criterion	-1.7096	-2.1036	-0.8665	-1.3617
Schwarz criterion	-1.3618	-1.7558	-0.5016	-0.9968
a) Johansen-Fisher (p):	0.0000	0.0000	0.0000	0.0002
b) Wooldridge AR (p):	0.0000	0.0000	0.0002	0.0002
c) Granger Causality (p):	0.0700 0.8509	0.1818 0.0445	0.1595 0.2374	0.6090 0.0159

Notes: *P-values on last three lines are based on null hypotheses of: a) No Cointegration (from the Johansen-Fisher test; c.f. Note to Table 2); b) <u>No</u> first-order serial correlation (Wooldridge AR test); and c) No Granger Causality. For c), the first p-value is given for the null that the 'independent' variable does not Granger cause the 'dependent' variable; the second is for the null that the 'dependent' does not Granger cause the 'independent' variable, at the given lags. The influence of the error correction term is not considered here.*

The elasticity of Velocity on the first-lagged moving average of Value Added is more negative than that of Balances for Registered firms: -2.8905 (column 3) vs. 0.6599 (regression on Balances not shown). As in Lemma 3, Velocity (not Balances) can be seen to drive the countercyclical response of WIR Turnover for Registered firms: We test the null hypothesis that the elasticity of Velocity is greater than or equal to that of Balances, against the alternative hypothesis that it is less than that of Balances. The Wald t-test (one-tailed) has this null decisively rejected at p-values of 3.79e-07 or 2.20e-05, using the regressions on Velocities or Balances respectively.

For Non-Registered firms, on the other hand, Balances should drive countercyclical Turnover. The elasticity of Balances is less than that of Velocity at one lag: -0.8767 (column 4) vs. 0.2874 (regression on Velocity not shown). We now test the null hypothesis that this elasticity of Balances is greater than or equal to that of Velocity. The Wald t-test shows this null rejected at p-values of 0.0022 or 0.0254, using the regression on Balances or Velocities respectively. Thus, as in Lemma 3, the elasticity of Balances 'dominates' Velocity to drive the countercyclical responsiveness of Turnover for Non-Registered firms – the opposite condition for Registered firms. As noted, this is consistent with the pattern of the larger Non-Registered firms accepting payments from smaller Registered firms with a larger portion of WIR during a recession, and holding these WIR-Balances longer. (Recall that Non-Registered firms are not required to accept a minimum portion of their payment in WIR.)

There is another interesting panel test for the countercyclical effects of Registered and Non-Registered firms. Instead of using the output of each of the six different sectors as the dependent variable, as in Table 4, we can use the same Swiss GDP for all of them, as in Table 5 below. Note that the first approach captures countercyclical responsiveness of WIR expenditures for the sector, while the second is a measure of overall macroeconomic stabilization.

For Registered firms in Table 5, the elasticity of Velocities on first-differenced GDP lagged two periods is less than that of Balances: -3.6674 (column 3) vs. 1.883 (regression on Balances not shown). Velocity is seen to drive the countercyclical response of Turnover for Registered firms (Lemma 3). Testing the null that the elasticities of Balances is greater or equal to that of Velocities: The Wald t-test shows this null can be rejected decisively at p-values of 4.29e-05 or 2.61e-05, using coefficient estimates from the regressions on Velocities or Balances respectively.

Table 5: Registered and Non-Registered WIR Clients –
Log of Real <u>WIR Turnover</u> Regressed on Log of Real <u>GDP</u>
*t-statistics in ( ); ***: p-val ≤ 0.01, ** : p-val ≤ 0.05, *: p-val ≤ 0.10, °: p-val ≤ 0.15*

Method: Vector Error Correction Model, Panel Data, Fixed Effects *White cross-section (no d.f. correction)* Sample (adjusted): 1995 2008 Periods: 14, Cross-sections: 6			Sample (adjusted): 1995 2007 Periods: 13, Cross-sections: 6	
COINTEGRATING EQUATION	Dependent Variable: **LRWirTURN (Reg)**	Dependent Variable: **LRWirTURN (Non-Reg)**	Dependent Variable: **LRWirVEL (Reg)**	Dependent Variable: **LRWirBAL (Non-Reg)**
Variable	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**
Constant	19.5032	21.5842	6.4667	13.1071
	[19.002] ***	[15.517] ***	[4.755] ***	[28.586] ***
LRGDP(-1)	-1.2736	-1.6489	-0.8356	-0.3808
	[-7.581] ***	[-7.246] ***	[-3.749] ***	[-5.047] ***

VECTOR ERROR-CORECTION EQUATION	**D(Dependent Variable)**	**D(Dependent Variable)**	**D(Dependent Variable)**	**D(Dependent Variable)**
Variable	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**
Cointeg_Equa_RES(-1)	-0.3008	-0.3720	-0.0199	-0.4134
	[-1.549] o	[-8.158] ***	[-1.415]	[-2.831] **
D(Dependent Var. (-1))	-0.3032	-0.4459	-0.5415	-0.5958
	[-2.459] **	[-6.486] ***	[-3.991] ***	[-4.846] ***
D(Dependent Var. (-2))	-0.2268	-0.0648	-0.2158	0.0386
	[-5.618] ***	[-2.433] **	[-1.773] o	[0.217]
D(LRGDP(-1))	-0.3136	0.7082	-0.6731	0.9206
	[-0.537]	[1.542] O	[1.137]	[1.694] *
D(LRGDP(-2))	**-0.5937**	**-1.4037**	**-3.6774**	**-1.2617**
	[-1.498]	**[-6.193]** ***	**[-3.337]** **	**[-1.606]**
Constant	-0.0193	-0.0455	-0.0488	-0.0103
	[-1.637] o	[-5.141] ***	[-2.945] **	[-0.554]
R-squared	0.2624	0.4914	0.3016	0.5167
Adjusted R-squared	0.1415	0.4080	0.1620	0.4288
S.E. of regression	0.0986	0.0745	0.1561	0.1135
Sum squared resid	0.5935	0.3385	1.0973	0.7089
Log likelihood	70.5778	90.7900	29.6056	55.9634
F-statistic	2.1701	5.8928	2.1600	5.8802
Prob(F-statistic)	0.0319	0.0000	0.0434	0.0000
Mean depend, var	-0.0197	-0.0409	-0.0106	-0.0108
S.D. depend. var	0.1065	0.0968	0.1705	0.1502
Akaike info crit.	-1.6549	-2.2164	-0.7124	-1.3625
Schwarz crit.	-1.3071	-1.8686	-0.3479	-0.9976
a) Johansen-Fisher (p):	0.0740	0.2718	0.0129	0.3899
b) Wooldridge AR (p):	0.0008	0.0000	0.0162	0.0006
c) Granger Causality (p):	0.5232 0.0006	0.1069 0.1387	0.0657 0.0005	0.3561 0.2381

***Note**: See Table 4.*

For the Non-Registered firms in Table 5, the elasticity of Balances on GDP lagged two period is less than that of Velocities: -1.2617 (column 4) vs. -0.2346 (regression on Velocities not shown).

Balances are again seen to 'dominate' the countercyclical response for Non-Registered firms. We test the null hypothesis that the elasticity of Balances is greater or equal than that of Velocities: Wald t-tests show this null rejected at p-values of 0.0190 or 0.0214, using the regressions on Balances or Velocities respectively.

We will now explore the countercyclical patterns in the individual industrial sectors. Comparing the elasticities of Balances vs. Velocities between Registered and Non-Registered firms is of uncertain value, however, since there is no reason to believe that WIR trade is mostly intra-industry. A manufacturing firm is about as likely to trade with a wholesaler as with another manufacturing firm, and so on. Nonetheless, substantial intra-industry trade may in fact exist, as a similar pattern re-emerges with most sectors. We begin with Construction, in Table 6 below. Recall that this is the sector with by far the greatest WIR Turnover, and with 37 percent of its firms accepting WIR credits (Table 3).

Similarly to the previous Tables 4 and 5, we see here the first lagged Value Added term with a (negative) countercyclical sign. In columns (1) and (3) we see that the elasticity of Turnover for Registered firms is dominated by that of of Velocity. And similarly for Non-Registered firms, in columns (2) and (4) we see the elasticity of Turnover dominated by that of Balance. The strong countercyclical trend of WIR Construction – itself an industry that is highly procyclical– may help explain why the panels regressions in Tables 4 and 5 do not show as robust a trend as the aggregate time series of Table 2. Recall that in the panel data, Construction is just one sector of six. In the aggregate it is weighted by value.

Here we are using just the annual Value Added term, and not its moving average as in Table 4. (The significance of this one year lag suggests that Construction is quicker to respond to cyclical trends than other sectors – as seems reasonable.) Most of the statistical tests here are similar to those in Tables 4 and 5, with the exception of that for Autoregressive errors. Note that while all our regressions are Vector Error Correction (VEC) Models, Tables 4 and 5 were based on panel data, whereas Tables 2 and 6 are simple time series. We thus use a Lagrange Multiplier test set for serial correlation. As opposed to the Wooldridge tests shown on the previous panel regressions in Tables 4 and 5, we now *cannot* reject the null hypothesis of no serial correlation – allowing us more confidence in the results.

Table 6: Registered and Non-Registered Clients, CONSTRUCTION Sector: Log of Real WIR Turnover, Velocity and Balances in CONSTRUCTION (LrWirTurnC, LrWirVelC, LrWirBalC) Regressed on Log of Real Value Added in CONSTRUCTION, (LrVA_C)

*t-statistics in ( ); ***: p-val < 0.01, ** : p-val < 0.05, *: p-val <0.10, °: p-val <0.15*

Method: Vector Error Correction Model								
	Sample (adjusted): 1997 2008, Periods: 12				Sample (adjusted): 1997 2007, Periods: 11			
COINTEGRATING EQUATION	Column **(1)** **Dependent Variable: LrWirTurnC(-1) (Reg)**		Column **(2)** **Dependent Variable: LrWirTurnC(-1) (Non-Reg)**		Column **(3)** **Dependent Variable: LrWirVelC(-1) (Reg)**		Column **(4)** **Dependent Variable: LrWirBalC(-1) (Non-Reg)**	
Variable	**Coefficient**		**Coefficient**		**Coefficient**		**Coefficient**	
Constant	18.4092		20.1896		31.5695		15.9377	
LrVA_C	-0.5853		-0.7711		-3.0104		-0.4246	
	[-2.345]	**	[-4.877]	***	[-9.944]	***	[-2.588]	**
VECTOR ERROR-CORECTION EQUATION	**Dependent Variable: D(LrWirTurnC) (Reg)**		**Dependent Variable: D(LrWirTurnC) (Non-Reg)**		**Dependent Variable: D(LrWirVelC) (Reg)**		**Dependent Variable: D(LrWirBalC) (Non-Reg)**	
Variable	**Coefficient**		**Coefficient**		**Coefficient**		**Coefficient**	
Cointeg_Equa_RES(-1)	-0.5434		-0.5713		-0.1198		-2.7541	
	[-2.841]	**	[-2.864]	**	[-0.394]		[-1.674]	O
D(Dependent Var. (-1))	0.3873		0.2016		-0.0522		1.1804	
	[1.757]	O	[0.685]		[-0.089]		[0.788]	
D(Dependent Var. (-2))	0.3802		0.3058		-0.0368		-1.1713	
	[1.446]		[1.044]		[-0.085]		[-0.580]	
D(LrVA_C (-1))	**-1.0524**		**-0.7599**		**-1.1806**		**-2.9808**	
	[-3.139]	**	**[-1.852]**	o	**[-1.826]**	o	**[-1.548]**	
D(LrVA_C (-2))	0.5376		0.2063		0.3097		0.3926	
	[2.106]	*	[0.618]		[0.313]		[0.237]	
Constant	0.0011		-0.0137		-0.0298		0.0507	
	[0.098]		[-0.813]		[-0.911]		[0.421]	
R-squared	0.7764		0.7183		0.5618		0.8256	
Adj. R-squared	0.5900		0.4835		0.1236		0.6512	
Sum sq. resids	0.0048		0.0069		0.0206		0.1126	
S.E. equation	0.0284		0.0339		0.0642		0.1501	
F-statistic	4.1660		3.0597		1.2820		4.7341	
Log likelihood	29.8668		27.7566		18.9233		9.5924	
Akaike AIC	-3.9778		-3.6261		-2.3497		-0.6532	
Schwarz SC	-3.7353		-3.3836		-2.1327		-0.4361	
Mean dependent	-0.0202		-0.0336		-0.0296		-0.0112	
S.D. dependent	0.0444		0.0471		0.0686		0.2541	
a) Johansen-Fisher (p):	0.0316		0.0005		0.0013		0.0049	
b) Lagrangian AR (p):	0.3417		0.9958		0.0995		0.9909	
c) Granger Causality (p):	0.0021	0.3871	0.1667	0.1660	0.0656	0.0000	0.2845	0.0026

Notes: *See Table 2.*

Using the one-year lag on first-differenced ouptput, the elasticity of Velocity for Registered firms (-1.1806, column 3) is less than that of Balances (0.5369, regression on Balances not shown). The null that this inequality would be reversed is rejected at p-values of 0.0225 or 0.0315, using the regressions on Velocities or Balances respectively. Turning to Non-Registered firms, the elasticity of Balances (-2.9808, column 4) is less than that of Velocities (2.5163, regression on Velocities not shown). The null that this inequality is reversed is rejected at p-values of 0.0178 or 0.0028, using the regressions on Balances and Velocities respectively. Thus, as in the panel regressions and as in Lemma 3, Velocities drive the countercyclicity of Turnover for Registered firms, while Balances do so for the Non-Registered. The VECs run on other industrial sectors showed similar results, as we will see in the next section.

IV. Summary Statistics: Contingency Tables

Sector-by-sector VEC regressions (shown above only for Construction, Table 6) give further evidence of this 'standard countercyclical pattern.' This pattern was not replicated precisely by individual sector regressions, however: it varies considerably by functional specifications.

We ran a wide variety of functional forms. Rather than choosing a 'best' specification, Table 7 summarizes results for the following forms: a) one and two year lags of first-differenced Value Added by sector (as in Table 2, column 1); b) one and two year *Moving Average* lags of first-differenced Value Added by sector (as in Table 2, column 2); c) similar to a), but with a trend in the cointegrating equation; and d) similar to b), with a cointegrating trend.

Table 7 is a summary of contingency tables showing when the following conditions are met: i) the elasticity of WIR turnover is of countercyclical sign and significant, and ii) *either* the (negative) elasticity of Velocity dominates that of Balances, *or* the (negative) elasticity of Balances dominates that of Velocity by their magnitudes, as shown in Lemma (3). We count whenever these conditions are met for both Registered and Non-Registered firms. Note that there are 4 functional specifications for each relationship, and two lags for each independent variable. Thus there could be as many as 8 instances for most cells of Table 7. In fact, either the first or second lag is likely to be both of correct countercyclical sign and significant, so we should expect about 4 in most cells (except for Sums, which is 7 x 4 = 28).

Note that we show each of the 6 industrial sectors, plus Unified combining all 6 sectors, and the Sum that counts All Effects separately. The 'standard countercyclical pattern' is seen for Construction, Services, Wholesale, and the Sum tables, significantly so for the last two. Interestingly, Manufacturing reverses the pattern[7].

Table 7: <u>Countercyclical Dominance of WIR Balances (B) or Velocity (V),</u>
Registered and Non-Registered Firms, Several Functional Specifications

Sector	Yates	Pearson	Count_B= Reg	Count_B= Non-Reg	Count_V= Reg	Count_V= Non-Reg
SUM, All Effects	0.0856	0.0441	6	11	15	7
UNIFIED, All Sectors	0.8195	0.1709	1	3	1	0
CONST	0.6650	0.0833	0	1	2	0
RETAIL	NA	NA	0	0	2	1
HOSP	NA	NA	1	0	0	0
SERV	0.2357	0.0578	2	3	4	0
MANUF	0.2059	0.0350	2	0	1	5
WHOL	0.0528	0.0098	0	4	5	1

The p-values on the Pearson Chi-Squared two-tailed tests are given for each contingency table, with the Yates correction for continuity. (Chi-Squares could not be calculated for the Retail or Hospitality sector, given a zero row or column sum. Their tables are therefore greyed out.) Most of the

[7] Unique among the sectors analyzed here, regressions on Manufacturing showed countercyclical Velocity among Non-Registered, rather than Registered firms. We conjecture that the pattern of intra-sectoral purchases in this sector reverses that of the others. That is, rather than larger firms supplying output to (and accepting WIR credits from) smaller ones, here the smaller Registered firms supply parts to (and accept WIR credits from) the larger Non-Registered firms.

Pearson tests show statistical significance, but given sample size, the Yates p-values should probably be used for all except the "Sum" table. These statistical results suggestive, but not strong enough to be dispositive. Along with the regressions of Tables 4 and 5, however, they provide further evidence for the standard countercyclical pattern derived in Lemma 3.

V. Conclusions

Previous work (Stodder, 2009) and the regressions in Table 2 show WIR activity to be countercyclical for some 60 years. Tables 4, 5 and 6 show this countercyclical trend also for a more recent period, and within major industrial sectors. Regressions give evidence of the 'standard countercyclical pattern' of WIR-exchange, as derived in Lemma (3): As with trade credits, larger Non-Registered firms supply both product and credit to smaller Registered firms. The Balances of Non-Registered firms, and the Velocities of Registered, play the leading countercyclical roles.

It is clear from Table 3 that WIR is an important part of the credit picture for SMEs in Switzerland, and even for some large Non-Registered companies. But is this WIR-Bank so peculiarly Swiss as to frustrate any general conclusions? After all, it has no foreign branches. Nevertheless, the best evidence for viability may be its very "pan-Swiss" nature. That is, the WIR does *not* exist solely in one language-region, unlike other Swiss cooperatives (Ostrom, 1990). It has long had German, French, and Italian-speaking memberships in rough proportion to their Swiss populations (WIR *Rapport de Gestion*, various issues). This suggests similar institutions could work in different countries.

What about the inflationary potential of such a network? There is a considerable literature (Mankiw, 1993; Mankiw and Summers, 1986; Bernanke and Gertler, 1995; Gavin and Kydland, 1999) showing that money supply is pro-cyclical. Even less controversial is the finding that Velocity is highly pro-cyclical (Tobin, 1970; Goldberg and Thurston, 1977; Leão 2005). By contrast, our earlier VEC models (Stodder, 2009) show WIR Turnover and Swiss money supply to be negatively correlated.

Two points seem worth making here. First, if WIR Turnover is countercyclical while ordinary currency Turnover is procyclical, then increases in WIR should be less inflationary than increases in the national currency.[8] Second, WIR activity may 'leverage' a more economic activity than its small size suggests. Data for 2007 show total WIR Balances (612 million in SFr) at only one-quarter of one percent of the basic Swiss money supply, M1 (IMF, 2009). This seems quite trivial, until one considers:

- The penetration of WIR into many sectors; e.g., 37 percent of all Swiss construction firms (Table 3).
- Nearly twice as many Non-Registered as Registered firms (Table 3), including, as WIR statistician Winkler (2010) notes, some that are large and well-known. (WIR activity of these larger Non-Registered firms may not be widely-known due to its business-to-business, 'trade credit,' and largely non-advertised nature. WIR publications go primarily to Registered members.)
- Non-Registered firms show overall Turnover levels only slightly below that of Registered firms. This is consistent with the model of this paper, reciprocal exchange between firms of quite different scale, larger Non-Registered firms and the SMEs that are Registered WIR members.
- Lemma 3 and several dozen regressions show this structured reciprocity between large and small firms as basic to the countercyclical resiliency of WIR.
- The Non-Registered companies, since they are larger but have smaller average WIR balances (Table 3), show a higher 'leveraging' of SFr by WIR credits, as predicted by Lemma 2.

These combined factors show WIR as a potent countercyclical force. Without knowing the Swiss Franc expenditures of WIR clients, we cannot calculate the overall Keynesian 'multiplier' on WIR expenditures. The above suggests, however, that it will be larger than any conventional multiplier.

Lietaer et.al. (2009) argue that complementary currency systems such as WIR, like sustainable natural systems, show an optimal tradeoff between resiliency and efficiency. This contrasts to the brittle efficiency of our current financial system. WIR's resiliency does seem "natural" – created by the countercyclical flow of reciprocal trade itself. Given its countercyclical "leverage," the overall systemic stability gained from WIR, as from a small but ecologically critical "keystone" species, may be greater than its tiny economic footprint suggests.

[8] Our earlier estimates (Stodder 2009) show that WIR are most likely to be accepted when ordinary (pro-cyclical) currency is in short supply. Thus, WIR Turnover is likely to concentrate most where its inflationary potential is the least.

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