The Macro-Stability of Swiss WIR-Bank Spending: Balance and Leverage Effects[1] (Sept. 29, 2010)

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Abstract: Since 1934 the Swiss Wirtschaftsring ("Economic Circle") or WIR-Bank, has issued its own currency. This WIR-money is used in a highly counter-cyclical fashion: 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 through the generation of new bank *balances*, rather than increased velocity. This is confirmed with panel data on transactions by industrial sector. WIR balances are more counter-cyclical for larger firms, and play a role similar to trade credits supplied to smaller customers and distributors. The counter-cyclical multiplier on WIR expenditures is thus 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 counter-cyclical. This stabilizing effect should be of interest for monetary policy. After all, if a secondary currency can improve dynamic efficiency, then standard monetary policy cannot be optimal. But what is the mechanism of this stabilizing effect? Stodder noted what a Swiss economist (Studer, 1998, p. 31) has called the WIR's "autonomous money creation" and "automatic plus-minus balance of the system as a whole." Stodder (2009) considered the role of bank *balances* in generating this counter-cyclical pattern of WIR *turnover* (= balances *times* velocity), but lacked adequate data on balances for tests.

With a new disaggregated data set with data on WIR balances, we can now show that WIR Balances (not Velocity) are the counter-cyclical driver. Data on transactions by industry and type of bank customer also show that counter-cyclical WIR activity is more pronounced among "Non-Registered" firms. Such non-member firms are free to accept only as much WIR-currency as they wish,

[1] I would like to thank Stefan Winkler, a statistician for the WIR-Bank, for his generous aid in interpreting the bank's data aggregated by sector. Thanks also to the participants in a seminar given at the Centre for European Research in Microfinance (CERMi), University of Brussels, and especially to Bernard Lietaer for several helpful comments.

and apparently are most likely to do so when the opportunity for other forms of payment is especially low – that is, during recessionary periods.

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

There are hundreds of alternative-currency examples in existence today, 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, 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 Ring") is not only the largest but also the oldest exchange based solely on a private or 'club' form of money. The recent finding by Stodder (2009) that WIR activity has been highly countercyclical was based on data from 1948 to 2003. Using more recent data does not change that conclusion.

Table 2 below (with 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. Stodder (2009) shows a structural break in the early 1970s, due to changes in WIR policy. But for our counter-cyclical hypothesis, what is important is the negative and significant counter-cyclical sign in the Vector Error Correction portion of the model, on the first lag of the first-differenced GDP terms, D(LrGDP(-1)) and D(LrGDPAV2(-1)), (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, 4-7

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

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: lnWirTurn**	
LrGDP(-1) ‡	3.0685 [-6.551]***	4.0548 [-4.911]***
Constant	-10.8162	-16.3450
Independent Variables:		
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 LrGDPAv2(-t), and D(LrGDPAv2(-t)).

(*) 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 dependent variable from the error correction term.

According to WIR-Bank statistician Stafan Winkler (2010), its clients form a significant part of the Swiss total in several industrial sectors, as the following table 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 Stefan Winkler (2010), a statistician for WIR–Bank, these numbers understate the weight of the Non-Registered group in that some very large corporations are included therein. 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 "dedicated" to WIR in the sense that they must take a fixed percent (typically 50%) of their first 2,000 SFr of customer invoices in WIR. We will explore the implications in the econometric section of the paper.

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	2.72
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	3.83
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

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 will be household memberships (Winkler, 2010).

Note that although total Balances of Non-Registered Client Enterprises are about twice those of Registered Clients in most industries (except in Retail and Hospitality), the Turnover for both groups is often quite similar. This is because the Velocity (= Turnover/Balance) at which Balances circulate is always higher for Registered Clients. This seems to reflect the more active use of WIR reserves among Registered Clients. These may have a larger proportion of customers or suppliers who are also WIR members.

This leaves open the question, however, of how such usage changes in an economic downturn. We shall see that Turnover tends to pick up during a recession for both Non-Registered and Registered Clients, but that this is driven primarily by the increased Balances of the former. This, we conjecture, represents a form of *non-bank credit* that larger firms are extending to SME, analogously to the credit extended through trade-credits in the commercial economy as a whole (Nilsen, 2002).

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.)

The long-term counter-cyclical activity of WIR Turnover is demonstrated by Table 2 above, and the previous study of Stodder (2009). The present study examines this activity on a sector-by-sector basis, and shows that this counter-cyclical tendency is most pronounced in industrial sectors which are themselves highly *pro*-cyclical, such as Construction.

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). 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.

In a Philadelphia Fed publication, Mitchel Berlin (2003) notes that despite their role as the principle form of short-term credit for SMEs, there has been little work on trade credits. 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 counter-cyclical for small firms, since they are more likely to be credit-rationed by banks when money is tight, and trade credits are often the only form of credit left to them. This is consistent with the finding of the present paper: Turnover among Registered WIR clients – restricted to SME by its constitution (Defila, 1994) – is also highly counter-cyclical. However, we find that Non-Registered WIR clients show an even greater degree of counter-cyclical activity, based largely on balances. Possible reasons for this will be explored.

One likely reason, suggested to the author in comments by Bernard Lietaer,[2] is that Non-Registered clients, unlike those Registered, are not subject to the organization's by-laws and obliged to accept a minimum share of payment (20%) in WIR. Thus they are free to be more flexible in extending the privilege of WIR-settlement to their most favored customers and clients, and to extend more credit in this form only when it is most needed, during economic downturns. This could explain much of the greater counter-cyclical variability in Non-Registered accounts, and would perform a role quite similar to that of trade credits.

[2] During discussions at the Microfinance Seminar, Université Libre de Bruxelles, June 2010.

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: while the individual's debit position is set by overdraft limits, the absolute value of all credits and debits is determined only by economic need. The *net* of this total, meanwhile, is identically zero.[3]

A second difference with trade credits is that WIR-exchange is centralized, combining the functions of a commercial bank, and for 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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[3] 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) [4]. 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.[5] 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.[6] Only two economists Studer (1998) and Stodder (2009) seem to have studied its macroeconomic record.

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 economy closer to its efficiency frontier. There is a large 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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[4] Gesell would have been familiar with trade credits from his decades of international trade experience in 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. Gesell applied a *demurrage* charge to the holding of money, with the aim of increasing its 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 in time, and from bilateral to multilateral.

[5] 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."

[6] Gerhard Rösl of the German Bundesbank (2006) does look at strictly Gesellian currencies – with zero interest rates and explicit holding costs. These explicit holding costs were called *demurrage* by Gesell, but Rösl uses the term *Schwundgeld*, or 'melting currency'. Such currencies have grown in popularity in low inflation environments like the current Euro area (as Rösl documents), and in 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, however, 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) model, 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:

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

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

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 considered divisible, since in practice goods and services are often posted as available for purchase at a mix of WIR and SFr, usually at least 30% in the former. 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 Q 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. K_p and K_s however, are assumed perfect substitutes; subscripts are to account only for their means of purchase.

It is assumed that $r_p > r_s$ and $c_p \leq c_s$. The first inequality arises because primary money is more useful than secondary, and thus has a higher opportunity cost. The second arises because, given this unequal usefulness, items for sale are in practice usually posted at higher prices in WIR than in SFr., even though these are considered comparable units (Stodder, 2009).

Lemma 1: For a cost minimizing firm, the marginal productivity of K_s is at least as great as that for K_p, and that of m_s is less than m_p.

Proof: Using the above inequalities and the constraint in (1), the first order conditions yield $(c_s/c_p) = (\partial f/\partial K_s)/(\partial f/\partial K_p) \geq 1 > (r_s/r_p) = (\partial f/\partial m_s)/(\partial f/\partial m_p)$.

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, consider Registered firms to be of type 1 and the Non-Registered to be type 2:

Lemma 2: If firm 1 is more credit constrained than firm 2 for primary currency, $r_p^1 > r_p^2$, then ceteris paribus, firm 1's holdings of secondary currency will be relatively larger: $m_s^1/m_p^1 > m_s^2/m_p^2$.

Proof: The ratio r_s/r_p will be lower for the credit constrained firm 1, and similarly its marginal product of m_s compared to m_p, by the first order conditions shown in Lemma 1. With the same production/transformation function f( ), firm 1 must hold a larger ratio of secondary to primary currency.

Table 3 shows that Registered firms have larger average balances of WIR. Since the average size of Registered firms is less than Non-Registered, Lemma 2 seems to be empirically confirmed.

Smaller Registered clients (of type 1, in Lemma 2) may be quite limited in their access to credit for primary currency, even without a recession. And as we have seen in the 2008-2009 recession, smaller firms may loose credit access altogether. Thus it is not unreasonable to suppose that the rise in interest rates for Non-Registered clients (type 2) may actually be greater than that for smaller Registered clients (type 1), who may never had good access to begin with. This would lead to a larger increase in WIR Balances for the larger Non-Registered clients (type 2):

Lemma 3: *If the business cycle brings a larger change in primary currency interest rates for firm 2 than for firm 1, $\Delta r_p^2 > \Delta r_p^1 \geq 0$, then the increase in holdings of secondary currency will be greater for firm 2: $\Delta m_s^2 > \Delta m_s^1 \geq 0$.*

Proof: Immediate from the previous Lemmas.

These results imply that WIR Balances vary with counter-cyclical activity. Similarly, the description of Studer (1988, p. 31) – as well as a simulation trading game by LETS founder Michael Linton and his associate, Eric Harris-Braun (2007) – show that WIR Balances build (and are built up by)

increased reciprocal trade. Thus we should see WIR Balances growing during a recession. We now set out to test these results.

III. Econometric Tests

Although the relation with GDP is interesting, we should also note the link between Numbers of Unemployed and WIR activity. Previous estimates (Stodder, 2009) have shown this cyclical indicator to be even more closely tied to WIR, and there are good reasons why this should be so.

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

Vector Error Correction (VEC) models are a natural way of checking both stability and counter-cyclical activity. If all are growing in an expanding economy, then the long-term relationship between GDP, the Number of Unemployed, and WIR activity – as shown in the Error Correction (EC) equation – should all be *positive*. If WIR activity is countercyclical, then the relationship between changes GDP or the Number of Unemployed on the one hand, and changes in WIR activity and the other – as shown in the Vector Auto Regression (VAR) portion of the VEC – will be *negative* or *positive*, respectively. This is a relation between short-term or "cyclical" deviations, as opposed to long-term "secular" growth.

Because our time series is fairly short, just 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 any counter-cyclical effects will show up.

In Table 4 below, it is seen that the coefficients on first-differenced GDP (**highlighted** for convenience) have the expected negative counter-cyclical sign for the Turnover of both Registered and

Non-Registered Firms, when lagged two years. Note that the sign on these coefficients is generally positive but insignificant when the differences are lagged for one period, but negative and significant for a two period lag. For Non-Registered firms, the coefficients on both of Turnover and Balances have the expected counter-cyclical sign (negative).

From the log-log form, these coefficients are in fact the elasticities of the original variables. Thus, the second-year-lagged GDP elasticity of Non-Registered Turnover is of similar magnitude to that of Non-Registered Balances: -1.4037 and -1.2617 in columns (2) and (4), respectively. Balances (rather than Velocity) can thus be seen to drive the counter-cyclical result for Non-Registered firms: the elasticity of Turnover must equal the sum of the Balance and Velocity elasticities. If we test the null hypothesis that the GDP elasticities of Turnover and Balances are equal in regressions (2) and (4), the Wald statistic F-test shows this null can be rejected only at p-values of 0.857 and 0.533, respectively. Thus their elasticities are too close to be statistically distinguished, and we cannot reject the null that they may in fact be equal.

It is useful to note that strict equality of these elasticities is not needed to prove that the elasticity of Balances, rather than Velocity, drives the behavior of Turnover. All we require is that they be 'close.' The Elasticity on Turnover (E_T) is the sum of elasticities on Balances (E_B) and Velocity (E_V), $E_T = E_B + E_V$. Thus if E_T minus E_B is close to zero, then so is E_V.

The other regression results in Table 4 are mildly encouraging, with the exception of the p-values on the Wooldridge (2000) null hypothesis of no first-order auto-regression. This null must be rejected, and there is a likely problem of serial correlation. Things may not be so bad as they seem, however.

Note that in Table 4 and Table 5 below, we are using White (1980) period estimators, robust to within-cross-section serial correlation (Arellano, 1982). This means that our coefficient estimates are unbiased, even though they are not efficient; i.e., do not have standard errors as small as possible. Thus despite serial correlation, the coefficient estimates below are reasonable approximations, and are likely to be even more significant than they appear. We can be fairly confident about the results.

Table 4: Registered and Non-Registered WIR Clients –
Log of Real WIR Turnover and Balances Regressed on Log of Real GDP
*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	Column **(1)** Dependent Variable: **LRWirTURN (Reg)**		Column **(2)** Dependent Variable: **LRWirTURN (Non-Reg)**		Column **(3)** Dependent Variable: **LRWirBAL (Reg)**		Column **(4)** Dependent Variable: **LRWirBAL (Non-Reg)**	
Variable	**Coefficient**		**Coefficient**		**Coefficient**		**Coefficient**	
Constant	19.5032 [19.002]	***	21.5842 [15.517]	***	13.0365 [10.709]	***	13.1071 [28.586]	***
LrGDP(-1)	-1.2736 [-7.581]	***	-1.6489 [-7.246]	***	-0.4380 [-2.206]	**	-0.3808 [-5.047]	***

VECTOR ERROR-CORECTION EQUATION	**D(Dependent Variable)**		**D(Dependent Variable)**		**D(Dependent Variable)**		**D(Dependent Variable)**	
Variable	**Coefficient**		**Coefficient**					
Cointeg_Equa_RES(-1)	-0.3008 [-1.549]	o	-0.3720 [-8.158]	***	-0.4740 [-2.172]	**	-0.4134 [-2.831]	***
D(Dependent Var. (-1))	-0.3032 [-2.459]	**	-0.4459 [-6.486]	***	-0.0660 [-0.361]		-0.5958 [-4.846]	***
D(Dependent Var. (-2))	-0.2268 [-5.618]	***	-0.0648 [-2.433]	**	-0.1001 [-1.665]	o	0.0386 [0.217]	
D(LrGDP(-1))	**-0.3136** **[-0.537]**		**0.7082** **[1.542]**	**O**	**0.9015** **[0.864]**		**0.9206** **[1.694]**	*****
D(LrGDP(-2))	**-0.5937** **[-1.498]**	**o**	**-1.4037** **[-6.193]**	*******	**1.8827** **[1.535]**	**o**	**-1.2617** **[-1.606]**	**o**
Constant	-0.0193 [-1.637]	o	-0.0455 [-5.141]	***	-0.0611 [-4.461]	***	-0.0103 [-0.554]	
R-squared	0.2624		0.4914		0.2862		0.5167	
Adjusted R-squared	0.1415		0.4080		0.1565		0.4288	
S.E. of regression	0.0986		0.0745		0.1573		0.1135	
Sum squared resid	0.5935		0.3385		1.3614		0.7089	
Log likelihood	70.5778		90.7900		34.4265		55.9634	
F-statistic	2.1701		5.8928		2.2057		5.8802	
Prob(F-statistic)	0.0319		0.0000		0.0309		0.0000	
Mean depend, var	-0.0197		-0.0409		-0.0115		-0.0108	
S.D. depend. var	0.1065		0.0968		0.1713		0.1502	
Akaike info crit.	-1.6549		-2.2164		-0.7099		-1.3625	
Schwarz crit.	-1.3071		-1.8686		-0.3450		-0.9976	
Wooldridge AR (p):	0.0008		0.0000		0.0006		0.0006	
Granger Causality (p):	0.9828		0.6158		0.6540		0.5587	
Johansen-Fisher (p):	0.0740		0.2718		0.0129		0.3899	

Note: The last 3 (p) values are based on null hypotheses of: (Wooldridge AR) - No first-order serial correlation, (Granger Causality) - no Granger Causality, and (Johansen-Fisher) - no Cointegration. For this last, the p-value is the Johansen trace test.

We now compare the results of Table 4 to Table 5 below, where Number of Unemployed is now the independent variable. Once again, the two-period-lagged counter-cyclical Unemployment elasticity of Turnover (with a positive counter-cyclical sign) seems driven by the elasticity of Balance, which is of

a similar magnitude. Comparing these elasticity of Registered Firms' Turnover from the second lag of Unemployment in regression (1) and the elasticity of their Balances in regression (3), 0.0742 and 0.1163 – the null hypothesis of their equality can be rejected only at p-values of 0.2022 and 0.4820, respectively. Turning to the same elasticities for the Non-Registered firms in regressions (2) and (4), 0.0991 and 0.0712 – the null hypothesis of their equality can be rejected only at p-values of 0.1991 and 0.6597, respectively. Once again, therefore, we see the cyclical behavior of WIR Turnover driven by the behavior of WIR Balances.

Note, however, the counter-cyclical response to Unemployment is clear for both Registered and Non-Registered client firms in Table 5, whereas for GDP in Table 4 it was clear only for the Non-Registered. Why might this be? Recall that smaller firms are more at risk from unemployment (Winter-Ebmer and Zweimüller, 1999; Winter-Ebmer, 2001), and also more subject to credit constraints (Terra, 2003; Small Business Administration, 1998). As we have noted, this leads to a greater reliance on trade credits for such firms (Nilsen, 2002; Petersen and Rajan, 1997). If we are correct that WIR Balances play a similar role to trade credits, then it seems likely that smaller, Registered firms may find:

a) their effective business cycle more closely tied to Unemployment than to GDP itself, and

b) their WIR activity more counter-cyclically tied to Unemployment.

This pattern seems supported by these regression results, which show more significant counter-cyclical elasticities for Unemployment in Table 5 than for GDP in Table 4. A similar pattern will also be seen in Tables 7 and 8 below, summarizing a large number of regressions, and showing a larger number of significant counter-cyclical regression coefficients for Unemployment than for GDP.

Table 5: Registered and Non-Registered WIR Clients – Log of Real WIR Turnover and Balances Regressed on Log of Number of Unemployed

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

Method: Panel Least Squares, 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	Column **(1)** Dependent Variable: **LRWirTURN (Reg)**	Column **(2)** Dependent Variable: **LRWirTURN (Non-Reg)**	Column **(3)** Dependent Variable: **LRWirBAL (Reg)**	Column **(4)** Dependent Variable: **LRWirBAL (Non-Reg)**
Variable	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**
Constant	11.1889 [41.765] ***	11.0154 [30.486] ***	10.7722 (61.740) ***	10.9769 [188.253] ***
LUE(-1)	0.1211 [2.106] **	0.1163 [1.515] ***	-0.0673 [-1.813] *	-0.0259 [-2.132] **
TREND			-0.0091 [-2.585] **	-0.0073 [-4.604] ***

VECTOR ERROR-CORECTION EQUATION	**D(Dependent Variable)**	**D(Dependent Variable)**	**D(Dependent Variable)**	**D(Dependent Variable)**
Variable	**Coefficient**	**Coefficient**		
Cointeg_Equa_RES(-1)	-0.1359 [-1.739] o	-0.0838 [-1.165]	-0.4719 [-2.501] **	-0.3511 [-2.017] **
D(Dependent Var. (-1))	-0.2949 [-10.245] ***	-0.6149 [-9.392] ***	-0.0667 [-0.398]	-0.6582 [-4.075] ***
D(Dependent Var. (-2))	-0.3194 [-4.466] ***	-0.0478 [-5.265] ***	-0.1140 [-1.698] *	0.0149 [0.067]
D(LUE(-1))	**0.0568** **[2.147] **	**0.0227** **[0.912]**	**-0.1532** **[-2.110] **	**-0.0627** **[-1.823] *
D(LUE(-2))	**0.0742** **[2.274] **	**0.0991** **[4.612] ***	**0.1163** **[1.956] *	**0.0712** **[1.128]**
Constant	-0.0320 [-11.432] ***	-0.0613 [-39.392] ***	-0.0168 [-4.772] ***	-0.0144 [-9.072] ***
R-squared	0.2912	0.4806	0.3213	0.5081
Adjusted R-squared	0.1751	0.3955	0.1978	0.4187
S.E. of regression	0.0967	0.0753	0.1534	0.1145
Sum squared resid	0.5703	0.3457	1.2947	0.7215
Log likelihood	72.0138	90.0371	36.0863	55.3812
F-statistic	2.5067	5.6446	2.6032	5.6811
Prob(F-statistic)	0.0136	0.0000	0.0116	0.0000
Mean depend, var	-0.0197	-0.0409	-0.0115	-0.0108
S.D. depend. Var	0.1065	0.0968	0.1713	0.1502
Akaike info crit.	-1.6948	-2.1955	-0.7602	-1.3449
Schwarz crit.	-1.3470	-1.8477	-0.3952	-0.9799
Wooldridge AR (p):	0.0003	0.0000	0.0003	0.0005
Granger Causality (p):	0.0585	0.1056	0.2273	0.6226
Johansen-Fisher (p):	0.0004	0.0000	0.0000	0.0000

Note: The last 3 (p) values are based on null hypotheses of: (Wooldridge AR) - No first-order serial correlation, (Granger Causality) - no Granger Causality, and (Johansen-Fisher) - no Cointegration. For this last, the p-value is the Johansen trace test.

Table 6: Registered and Non-Registered Clients, CONSTRUCTION Sector:

Log of Real WIR Turnover and Balances Regressed on Log of Real GDP- 2 Year Average

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

Method: Vector Error Correction Model, Least Squares Sample (adjusted): 1995 2008 Periods: 14, Cross-sections: 6			Sample (adjusted): 1995 2007 Periods: 13, Cross-sections: 6	
COINTEGRATING EQUATION	Column **(1)** Dependent Variable: **LRWirTURN (Reg)**	Column **(2)** Dependent Variable: **LRWirTURN (Non-Reg)**	Column **(3)** Dependent Variable: **LRWirBAL (Reg)**	Column **(4)** Dependent Variable: **LRWirBAL (Non-Reg)**
Variable	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**
Constant	9.0987	14.7489	-12.6043	-18.4514
LRGDPAv2(-1)	0.5643 [1.610] o	-0.3800 [1.670] o	3.9233 [6.585] ***	1.1176 [7.181] ***

VECTOR ERROR-CORECTION EQUAT.	**D(Dependent Variable)**	**D(Dependent Variable)**	**D(Dependent Variable)**	**D(Dependent Variable)**
Variable	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**
Cointeg_Equa_RES(-1)	-0.6165 [-3.877] ***	-0.7653 [6.375] ***	-0.5601 [-2.827] **	-4.6263 [3.404] **
D(Dependent Var. (-1))	-0.4087 [1.664] o	-0.4029 [2.766] **	-0.1831 [-0.639]	2.2549 [2.072] *
D(Dependent Var. (-2))	-0.1366 [-0.729]	-0.0396 [0.265]	-0.3235 [-1.036]	0.2966 [0.260]
D(LrGDPAv2(-1))	**-2.2225 [-2.189] ***	**-2.3287 [-3.382] ****	**-4.5543 [-1.428]**	**-8.7371 [-2.166] ***
D(LrGDPAv2(-2))	**-3.6244 [-2.078] ***	**-2.1725 [-2.067] ***	**0.9928 [0.405]**	**-4.6411 [0.852]**
Constant	0.0653 [3.137] **	0.0287 [2.228] *	0.0739 [1.183]	0.3525 [2.487] **
R-squared	0.8244	0.9256	0.8289	0.9267
Adj. R-squared	0.6781	0.8636	0.6577	0.8533
Sum sq. resids	0.0038	0.0018	0.0098	0.0473
S.E. equation	0.0252	0.0174	0.0443	0.0973
F-statistic	5.6343	14.9273	4.8431	12.6353
Prob(F-Statisitc)	0.0552	0.0083	0.0790	0.0163
Log likelihood	31.3180	35.7444	23.0224	14.3567
Mean dependent	-0.0202	-0.0336	0.0135	-0.0112
S.D. dependent	0.0444	0.0471	0.0756	0.2541
Akaike AIC	-4.2197	-4.9574	-3.0950	-1.5194
Schwarz SC	-3.9772	-4.7150	-2.8780	-1.3024
Lagr. Multip. AR (p):	0.2077	0.4107	0.4541	0.2716
Granger Causality (p):	0.0000	0.0000	0.3455	0.0153
Johansen-Fisher (p):	0.0176	0.0004	0.0106	0.0134

Note: The last 3 (p) values are based on null hypotheses of: (Lagrange Multiplier AR) - No serial correlation at the number of lags specified (2), (Granger Causality) - no Granger Causality, and (Johansen) - no Cointegration. For this last, the p-value is always the Johansen trace test.

In Table 6 above, we turn to the largest sector in the WIR network, Construction. Most of the statistical tests are similar to Tables 4 and 5, with the exception of that for Autoregressive errors. Note that although all the regressions in this paper are in the form of Vector Error Correction Models, Tables

4 and 5 are based on panel data, while Table 6 is a simple time series. We now use a Lagrange Multiplier test gauged for the specified number of lags – two in this paper. As opposed to the Wooldridge tests shown on the previous panel regressions in Tables 4 and 5, in Table 6 we *cannot* reject the null hypothesis of no serial correlation – thus allowing more confidence in the results.

In Table 6, we see that the GDP elasticities of Balances are not only as large as those on Turnover, they are generally a good deal larger. This is more than enough to prove that the elasticities of Balances are driving the result.

Comparing Average GDP elasticities on Balances in Columns (3) and (4), we see that those for Non-Registered firms in (4) are more than twice as large as those of Registered firms in (3). If Non-Registered firms are significantly more counter-cyclical in their WIR-activity than Registered firms, this suggests a conjecture. If WIR Balances act similarly to trade credits, then we would expect to see larger Non-Registered firms advancing credit to their best customers by accepting more WIR currency as payment during recessions. We have already seen, in Table 3, that Velocity tends to be much lower for Non-Registered than Registered firms. If during recessions, the larger Non-Registered firms also tended to *hold* such WIR currency for even longer – in an effort to help their smaller suppliers – this could show up as larger counter-cyclical Balance variation for these larger firms.

The time series in Table 2 shows that WIR activity has been counter-cyclical for almost 60 years. But what factors determine whether a particular industry shows counter-cyclical activity or not? Table 6 shows that WIR activity in one industry, Construction, where it has been strongly countercyclical. The panel of basic industry types, in Table 4 and 5, shows WIR to be only somewhat counter-cyclical.

Rather than test for a particular specification, we test for a family of specifications. The literature on non-parametric regressions has grown large in recent years; see Ellison and Ellison (1998) Lee and Ullah (2001). While the goal is usually to test regression specifications, a more preliminary task is to summarize general specification patterns. Summarizing our results in Table 7, we see that

only Construction shows a strong overall pattern of counter-cyclical WIR activity. Construction is, of course, among the most pro-cyclical of industries, so its need for counter-cyclical instruments may be greater. Recall from Table 3 that it is also the industry with the greatest value of WIR Turnover. Construction's weight in the WIR thus helps to shape our overall counter-cyclical results from both the ordinary time series and the panel data.

Table 7: Registered &Non-Registered Clients, All Industrial Sectors. Regression Summaries for Logs of Real WIR Turnover and Balances Regressed on Logs of Real GDP and Number of Unemployed

		Registered Clients No. of Sign. Occurs. Avg. Coeff.		Non-Reg. Clients No. of Sign. Occurs. Avg. Coeff.			Registered Clients No. of Sign. Occurs. Avg. Coeff.		Non-Reg. Clients No. of Sign. Occurs. Avg. Coeff.	
Indust	Dep Indep Variables	Counter-Cyclical	Pro-Cyclical	Counter-Cyclical	Pro-Cyclical	Dep Indep Variables	Counter-Cyclical	Pro-Cyclical	Counter-Cyclical	Pro-Cyclical
Construct	Bal_GDP	4	0	5	1	Bal_UE	4	0	2	0
		-6.3029	0.0000	-12.1508	9.6924		0.3897	0.0000	1.0193	0.0000
	Turn_GDP	2	0	6	0	Turn_UE	0	0	3	0
		-2.9235	0.0000	-2.2687	0.0000		0.0000	0.0000	0.3526	0.0000
Hospit.	Bal_GDP	0	0	0	4	Bal_UE	1	0	0	2
		0.0000	0.0000	0.0000	11.6929		0.0000	0.0000	0.0000	-0.7665
	Turn_GDP	0	0	0	3	Turn_UE	0	0	3	0
		0.0000	0.0000	0.0000	3.7542		0.0000	0.0000	3.7542	0.0000
Manufact	Bal_GDP	0	0	0	0	Bal_UE	0	0	0	4
		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	-1.0435
	Turn_GDP	0	0	0	0	Turn_UE	2	0	1	1
		0.0000	0.0000	0.0000	0.0000		0.1361	0.0000	0.1045	-0.4438
Retail	Bal_GDP	0	0	1	1	Bal_UE	2	0	3	0
		0.0000	0.0000	-6.7843	4.4931		0.6636	0.0000	0.5120	0.0000
	Turn_GDP	0	1	3	1	Turn_UE	2	2	0	4
		0.0000	4.6710	-3.7539	3.6228		0.1685	-0.2142	0.0000	-0.2145
Services	Bal_GDP	1	1	0	7	Bal_UE	0	0	0	1
		-4.2293	2.5030	0.0000	3.6148		0.0000	0.0000	0.0000	-0.1150
	Turn_GDP	1	6	0	3	Turn_UE	2	0	4	0
		0.0000	1.5850	0.0000	4.6598		0.2845	0.0000	0.5373	0.0000
Wholesale	Bal_GDP	0	0	0	0	Bal_UE	0	1	3	1
		0.0000	0.0000	0.0000	0.0000		0.0000	-0.1072	0.1435	-0.1380
	Turn_GDP	2	2	1	3	Turn_UE	2	0	2	4
		-3.1803	1.5431	-3.5616	2.3725		0.1997	0.0000	0.1647	-0.1638

Count shows the number of significant coefficients that are counter or pro-cyclical, out of a total of 8. Shadings show counter-cyclical (striped) or pro-cyclical (flat) tendency, darkness increasing with number of coefficients significant at the 10% level. The results of 192 regressions and 384 coefficients are summarized.

Table 7 summarizes the results of Vector Error Correction regressions similar to those carried out in Table 6, but performed on all six basic industrial sectors. Note that each of the cells contains:

a) An integer count between 0 and 8: the number of coefficients on Unemployment or GDP that were significant at the 10 percent level. (The highest possible value is 8, since there are 4 regressions for each pair of variables, each with 2 lagged terms.)
b) The average value of these significant coefficients.
c) A striped pattern for counter-cyclical effects, with flat shading for pro-cyclical, and darkness of the colors proportional to the number of significant variables.

Results in Table 7 are further characterized as "Counter" our "Pro" cyclical, according to whether the coefficient's sign on GDP is negative or positive, or one on Unemployment is positive or negative, respectively. While Construction is strongly counter-cyclical, Retail, Services, and Wholesale trade are all weakly so – although again we see a counter-cyclical pattern more clearly from Unemployment than GDP. WIR activity in some sectors, like Hospitality, appears *pro*-cyclical.

Table 7 summarizes regressions on 6 industries, each with 2 sorts of clients (Registered and Non-Registered), 4 different pairings of dependent (Balance or Turnover) and independent (GDP or Unemployed) variables, 4 different specifications, each with 2 coefficients of interest – a total of 192 regressions and 384 coefficients. The specifications are a regression on: (a) two single year realizations of the independent variable or two moving 2-year averages of the same, and (b) with or without a time trend. Thus there are 4 possible specifications for each dependent/independent variable pair, each with 2 timed observations of the independent variable: a total of 8 coefficients for each regression pair of dependent and independent variable.

The regression results summarized Table 7 show several statistically significant patterns, as seen in the following contingency tables:

1) <u>Unemployment shows stronger counter-cyclical WIR activity than does GDP</u>:

Table 8: Significant Cyclical Elasticities from Unemployment and GDP

	Counter-Cyclical	Pro-Cyclical	Non-Significant	Sums:
GDP Elasticity	26	33	133	192
Unemployment Elasticity	36	20	136	192
Sums:	62	53	269	384

Chi-Squared Statistic:	4.8350	*p-value:*	0.0891
Q-Statistic:	4.8749	*p-value:*	0.0874

Table 8 shows *more* non-significant coefficients than those showing a significant cyclical pattern of any kind. But recall from the time series in Table 3 and the panels in Tables 4 and 5 that the *overall pattern* on GDP and Unemployment is counter-cyclical. (This is driven by values of different industries, and not just numbers of industries.) Note also that change in the number of unemployed, a lagging business cycle indicator, shows more significant counter-cyclical coefficients than does change in GDP. This is consistent with the argument that WIR's *initial* counter-cyclical response is from smaller Registered firms – more sensitive to Unemployment risk than larger Non-Registered firms. But we seen Non-Registered firms as also be affected, since they agree to accept more WIR transactions from their small-business customers and distributors.

2) Non-Registered Firms show more significant cyclical effects – both counter- and pro-cyclical – than do Registered Firms:

Table 9: Significant Cyclical Coefficients in Registered and Non-Registered Firms

	Counter-Cyclical	Pro-Cyclical	Non-Significant	Sums:
Registered	25	13	154	192
Non-Registered	37	40	115	192
Sums:	62	53	269	384

Chi-Squared Statistic:	21.7316	*p-value:*	1.9101 E-05
Q-Statistic:	22.4333	*p-value:*	1.3449 E-05

Our previous panel regressions showed Non-Registered firms more counter-cyclical than Registered, and Table 9 shows that Non-Registered firms also have a far greater *number* of significant cyclical coefficients, with a slight preponderance of the pro-cyclical.

3) Most Registered and Non-Registered Firms are counter-cyclically sensitive to Unemployment, but are neutral or pro-cyclically sensitive to GDP:

Table 10: Significant GDP and Unemployment Elasticities, Registered and Non-Registered

	GDP Elasticity		Unempl. Elasticity			
	Counter-Cyclical	Pro-Cyclical	Counter-Cyclical	Pro-Cyclical	Non-Significant	
Registered	10	10	15	3	154	192
Non-Registered	16	23	21	17	115	192
	26	33	36	20	269	384

Chi-Squared Statistic: 22.9601 *p-value:* 1.2897 E-04
Q-Statistic: 24.1563 *p-value:* 7.4315 E-05

Table 10 is formed by overlaying the category divisions of Tables 7 and 8. Note the following contradictory result: Even though the panel regressions of Tables 4 and 5 show an *overall counter-cyclical pattern*, especially for Non-Registered firms, the *most common* response of Non-Registered firms to changes in GDP is pro-cyclical. If Unemployment is the true driver of counter-cyclical activity for WIR, then its position of a lagging indicator may have the effect of making the WIR response to GDP appear *pro*-cyclical. Our hypothesis that the response to Unemployment originates in Registered firms has some support here: while both firms show more counter- than pro-cyclical responses to Unemployment, the difference in response is far more pronounced for Registered firms.

4) The average of the significant GDP or Unemployment elasticities of Balances is almost twice that of Turnover:

Table 11: Average of Significant Elasticities on Balances Twice as Large as those on Turnover

Type of Elasticity	Averages		OLS: Balances on Turnover	
	Bal	Turn	Variable	Coefficient
GDP (counter-cyclical), Registered	-1.227	-0.509	Turnover	1.9803
GDP (pro-cyclical), Registered	0.104	0.719	*t-statistic*	*6.1180*
GDP (counter-cyclical), Non-Registered	-2.814	-1.185	R-squared	0.8424
GDP (pro-cyclical), Non-Registered	3.594	1.499	Adjusted R-squared	0.8424
Unemp. (counter-cyclical), Registered	0.120	0.066	S.E. of regression	0.7109
Unemp. (pro-cyclical), Registered	-0.004	-0.018	Mean depend. variable	-0.0385
Unemp. (counter-cyclical), Non-Registered	0.167	0.621	S.D. depend. variable	1.7906
Unemp. (pro-cyclical), Non-Registered	-0.248	-0.082	No. of Observations	8

The closeness of the fit of Balances regressed on Turnover is impressive, an R-squared of 84. Once again we have the implication, previously supported by Wald tests on the regressions in Tables 4 and 5, that Balances and not Velocities drive the counter-cyclical activity of Turnover. If, as the regression in Table 11 indicates, Balances have a counter-cyclical elasticity that is *greater* than that of Turnover, then the corresponding Velocity elasticities must be of the opposite sign from those on Turnover; i.e., they must actually be *pro-cyclical* – though not so much as to be fully offsetting.

IV. Conclusions and Discussion

Rather than de-stabilizing to the larger economy, as many of the world's largest banks have recently shown themselves, WIR-Bank seems to be stabilizing, especially in providing credit for small businesses. This counter-cyclical pattern is evident in almost 60 years of WIR data. If that stabilization is due to an ability to create new Balances *autonomously* – from the counter-cyclical flow of reciprocal trade itself, rather than deliberate bank policy – then the WIR-bank is deserving of further study.

Petersen and Rajan (1997) estimate that the total volume of trade credits for large US companies, their accounts payable and receivable, are one-third of their total assets. Like trade credits, WIR are a lifeline for firms most likely to be credit-rationed in a recession – SME (Nilsen, 2002). It is clear from Table 3 that WIR is a highly important part of the credit picture for SME in Switzerland, and also for some large Non-Registered companies.

Is this institution peculiarly Swiss? After all, the WIR-Bank has no foreign branches. Nevertheless, the best evidence for this type of network's international viability may be its very "pan-Swiss" nature. That is, the WIR does *not* exist solely in one language-region, unlike many other Swiss cooperatives (Ostrom, 1990). It has long had German, French, and Italian-speaking sections and memberships in rough proportion to their separate 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 the broad money supply is pro-cyclical. Even less controversial is the finding that the *velocity* of money is highly pro-cyclical (Tobin, 1970; Goldberg and Thurston, 1977; Leão 2005). The VEC models of Stodder (2009), by contrast, show that WIR Turnover and the ordinary Swiss money supply vary inversely over the short term.

Two points seem worth making here. First, and perhaps most obviously: if WIR Turnover is counter-cyclical while ordinary currency is pro-cyclical, then an increase in WIR should be less inflationary than a comparable increase in the national currency.[7]

Second, as Studer (1998) argues, the growth of the WIR money supply is autonomous and self-balancing. This automatic net balancing of WIR Balances – where new credits are matched by new debits – allows short-term fluctuations in real output to be matched by Balances. This allows for (but does not force) price stability. In terms of the quantity of money equation, Turnover ≡ Balances x Velocity ≡ P x Y. If Velocity is unchanged, then a proportional change in Balances will be matched by an equivalent change in Turnover – as is consistent with the Wald tests on the panel regressions in Tables 4 and 5. If this change in Balances is also equal to that in Y (goods and services), then the change in P (price) will of course be zero.[8]

WIR activity may 'leverage' a great deal more economic activity than its small size would suggest. Data for 2007 show total WIR Balances (612 million in SFr) are one-quarter of one percent of the Swiss money supply, M1 (IMF, 2009). This seems trivial, until one considers:

- The remarkable penetration of WIR into many small businesses (Table 4); e.g., 37 percent of all Swiss construction firms.

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[7] 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.

[8] The BV = PY identity would, of course, only be strictly true within a closed WIR-type system. In fact, WIR coexists with SFr. as a secondary or "residual" currency.

- 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. The WIR activity of the larger Non-Registered firms may itself not be so widely-known, because of its, 'trade credit,' business-to-business, and largely non-advertised nature. (WIR publication advertisements are primarily for Registered members.)
- These Non-Registered companies, if larger, should show a higher 'leverage' of SFr to WIR, as implied by Table 3 and predicted by Lemma 2.
- Our empirical findings that non-Registered companies behave more counter-cyclically in their WIR accounts than do Registered firms.

These combined effects show Non-Registered firms with greater numbers, larger average firm size, greater leveraging, and greater counter-cyclical activity (Tables 3-9) than their Registered counterparts. This means that WIR activity is a more potent a counter-cyclical force than one would guess from its small balances. Without knowing the normal currency expenditures of Non-Registered WIR clients, we cannot calculate the size of the 'multiplier' for new WIR spending during a recession. But as Bernard Lietaer has noted (personal communication, 2009), these combined effects mean that it is certain to be larger than the conventional Keynesian multiplier.

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