International Journal of Community Currency Research

VOLUME 17 (2013) SECTION A 45-57

COMPLEMENTARY CURRENCY AND ITS IMPACT ON THE ECONOMY

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ABSTRACT

The paper aims to show the impact that a complementary currency may have on a national economy from a theoretical point of view. A system dynamics model is created to describe the mechanics of money issuance in capitalist economies as well as in economies where there is no inside money. As an example, the first outcomes of a barter network implemented in 2008 by the STRO foundation in El Salvador (called *Punto Transacciones*) are presented and analyzed. Finally, using data from a complementary currency experience in El Salvador the spending multiplier is calculated. The main result shows that there is a greater spending multiplier in digital community currencies systems than in regular money market. Although the magnitude of PT network is still negligible from a macroeconomic point of view, the result is a desired outcome which may help to cushion the impact of macroeconomic shocks on labour market, contributing to stabilize aggregate demand.

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To cite this article: Groppa, O. (2013) 'Complementary currency and its impact on the economy' *International Journal of Community Currency Research* 17 (A) 45 - 57 <www.ijccr.net> ISSN 1325-9547

1. INTRODUCTION

The expansion of IT in recent years has brought about a number of innovations in the monetary arena. Firms have been experimenting with vouchers, discount coupons, sky miles, points, and the like, in order to attract customers or preserve them through loyalty programs. In parallel, complementary currencies (CC), many of which use computer-based exchange systems, have been growing year after year. These examples show in a greater or lesser degree the emergence of the quiet new phenomenon of private or non-national moneys.

A review of the literature on the subject reveals that few studies present a theoretical approach to the issue. Schraven (2000) analyzes the functions and benefits expected from joining in a complementary currency network, but he does not offer an explanation of their mechanism. Stodder (1998; 2009) finds a counter-cyclical effect of corporate barter systems as well as the WIR Bank's currency, respectively, using econometric techniques. Pjafjar et. al. (2012) use probit models to prove that community currencies are complementary (not substitutes) of national moneys and that the usage of these alternative currencies is associated with monetary stability, what constitutes a rather puzzling conclusion. Schroeder (2002), in his description of the Tauschring, offers some reflections on a handful of issues related to CC –unemployment, locality, ecology, between others. He does not either construct any formal model or explanation, but revisits some ideas of Gesell and his critics, or Lietaer. Krohn and Snyder (2008), in their study of Ithaca Hours, mention some characteristics of economies where complementary currencies appear, and describe the basic features of money. They also run a model in the US over the 1990's in order to find some effect of a higher growth rate in cities where complementary currencies had been deployed, but they can't find such evidence.

Most of the articles describe the main features of complementary currencies systems (CCS) in several experiences, either using the case study methodology (see IJCCR 2011; Schroder 2006; Lietaer 2004; Brenes 2011; Ingleby 1998) or conducting surveys (Lepofsky 2005; Jackson 1997). They usually detail the singularities of the implementation in each case.

The objective of the present paper is to analyze from a conceptual point of view the impact of CC in the monetary system. The first section presents a system dynamics model which describes the core of the structure of conventional monetary systems in our economies. The following section discusses what happens when a CC is introduced. Thirdly, empirical data from the complementary currency system developed by the Social Trade Organization (STRO) in El Salvador (called Punto Transacciones) is shown and a first attempt to measure the spending multiplier within the network is made. The final section concludes.

2. THE MECHANICS OF MONEY ISSUANCE

2.1 The Capitalist System

In our traditional economies money is created through a two-stage process. In the first place, a central bank issues debt –money– backed by its assets. It can be done as a means of monetizing a low liquidity debt (typically, when it purchases government's securities), or else by giving credit to commercial banks. This debt instrument has a high degree of liquidity and ability to be transferred to third parties, given that it is invested with an unrestricted settlement power. This is what we know as the monetary base or outside money.

With the money received, commercial banks offer loans. In turn, borrowed money is spent by credit takers (e.g., companies that purchase supplies and pay wages). Then, a subsequent circulation of means of payment takes place, which perform a given number of operations. There is, on the other hand, an amount of money that can be hoarded or saved in foreign assets. Conversely, it is also possible that previously hoarded amounts are re-entered into the circuit. In addition, there exists another portion of the amounts in circulation that is returned into the banking system in the form of deposits. In this case, commercial banks keep a portion as reserve to meet withdrawals, and are allowed to lend the remainder. In so far the original depositor continues using his money writing checks against his current account, that "remainder" provided by the commercial bank is new money put into circulation, what is known as inside money and is founded on the described fractional reserve system (as noted by Tobin 1963, strictly speaking this secondary issue occurs in the system as a whole, since credit creation by one bank may be absorbed –offset– as a deposit by another one.)

The money multiplier effect can also be seen as a dynamic system where secondary creation is defined by a recursive structure formed by deposits of savers that are put again into circulation as loans, generating expenditure (consumption and investment) and new savings deposited in the banking system. Since we are focusing in the structure of the money creation process (and not determining money supply), for the sake of simplicity we overlook interest rates and the flow of loan cancellation (which could be represented by an arrow from Income to Credit), as well as other types of deposits (saving or time deposits) or even more complex credit instruments like derivatives, swaps and others (which were in the very origins of the current crisis). The system is depicted in Figure 1.

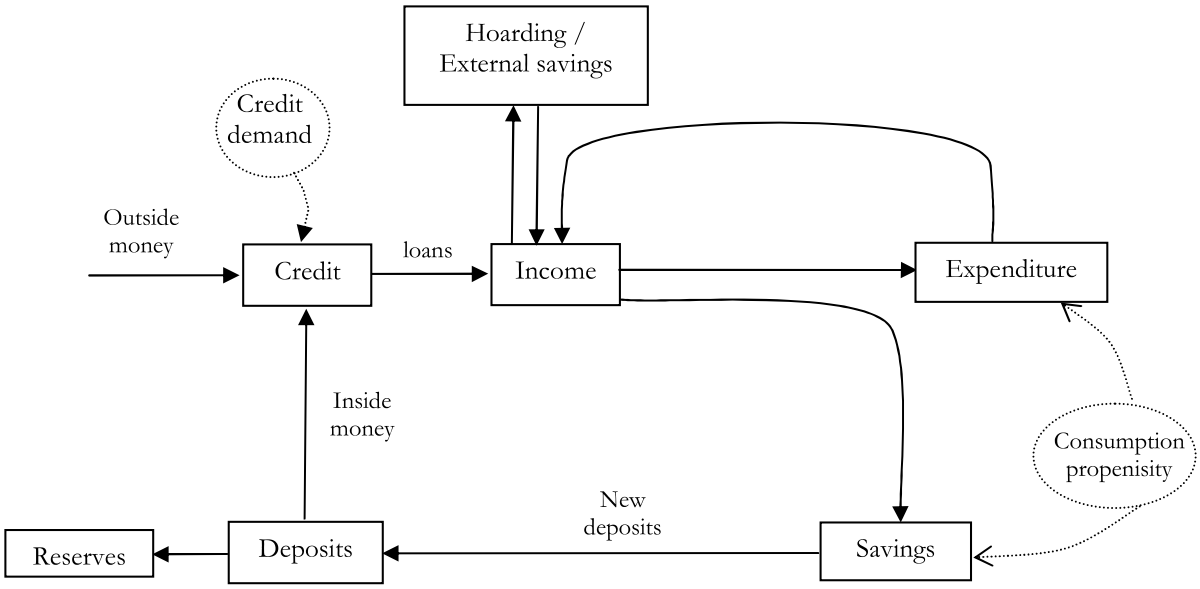


Figure 1. Diagram of money creation under capitalism

The diagram shows an initial flow (outside money) that is transformed into credit. Credit, from the side of the credit taker, is income that will be spent or else saved or hoarded. The spent portion is another agent´s income (hence the regressive loop). But, given that consumption propensity is less than 1, this "multiplier effect" (of expenditure or demand, in this case) has diminishing impact. The state variable Saving accumulates savings generated on each round of the spending multiplier. They are entered in bank system as deposits. Banks, after putting aside an amount as reserve, lend them again, carrying out a secondary issuance that will satisfy demand for credit. Thus, bank reserves perform an entropic function, as well as a positive net hoarding. The variable Hoarding is distinguished from Savings in order to remark its diverse function in relation to the economic system. The first one expresses the communication with the "outside world", while the second one has a role in the circulation and internal redistribution of monetary resources (allocating them, for example, to investment). Hoarding operates as a buffer receiving leakages from the system. However, given that any hoarding will be consumed at some future time, there is a returning flow to the system that will take place in an uncertain date. The magnitude of this cumulative variable depends on the time agents want to keep their savings outside the system, which is in turn function of real interest rates paid on savings within the system and on the ability to maintain the value of such amounts (e.g., by purchasing external assets, provided, of course, that its value is not overestimated, as in a financial bubble). The model is ideal in so far as it explains the structure of the money creating process, without reference to the behaviour of real variables. That is, the amount of credit issued is determined by demand, which is here an exogenous magnitude. Finally, notice that this system is defined by macroeconomic functions, and not by types of actors or currencies. In other words, those functions may be performed using cash, e-money or other currencies, whatsoever.

Therefore, the system has two instances of recursion (or "multipliers"), which form both geometric series: spending and monetary issuance.

2.2 Formal Expression

Figure 1 can be expressed as a simple system of difference equations based on the definition of the variables that comprise it. For simplicity, we assume that net hoarding is zero:

$$\begin{cases} Y_t = \sum_{\lambda=x}^{\Lambda} \beta^{\lambda t} Cr_t \qquad \lambda > 0 \\ Cr_t = e_{1t} + e_{2t} \\ e_{2t} = D_{t-1}(1-\varepsilon) \\ D_t = \sum_{\lambda=x}^{\Lambda} (1-\beta)^{\lambda t} Cr_t \end{cases} \tag{1}$$

Where Y_t is income generated within the monetary cycle t; β is the marginal propensity to consume; λt is velocity (with λ assumed to be fixed), that is, the number of outlays performed by monetary cycle (t) with a same original income; Cr is credit; e_1 and e_2 are outside money (which at first is data) and inside money, respectively; and D, deposits. The system can be summarized as:

$$Y_t = \sum_{\lambda=x}^{\Lambda} \beta^{\lambda t}\left[e_{1t} + \sum_{\lambda=x}^{\Lambda}(1-\beta)^{\lambda t} Cr_{t-1}.(1-\varepsilon)\right] \quad (2)$$

if only two cycles of issuance are considered. If it is desired to extend the time period, so that there were included w periods of monetary recurrence, the expression takes the following form:

$$Y_w = \sum_{\lambda=x}^{\Lambda} \beta^{\lambda t}\left[e_{1t} + \sum_{w=1}^{W}\sum_{\lambda=x}^{\Lambda}(1-\beta)^{\lambda t} Y_{t-1}.(1-\varepsilon)^{w}\right] \quad (3)$$

so that if λt and w tend to infinity,

$$Y_w = \frac{e_{1t} + \dfrac{Cr_{t-1}}{\beta.\varepsilon}}{1-\beta} \quad (4)$$

which summarizes the effects of both multipliers. The distribution in time of the multiplier effect depends, therefore, on the velocity of circulation of money.

3. COMPLEMENTARY CURRENCY SYSTEMS

3.1 Main Features

A CCS aims to create a submarket where means of payment circulate, preventing leakage from the system (reducing entropy) and hence maximizing local labour. It operates as a sort of virtual market protection.

Perhaps an element that distinguishes CCS from pure mutual credit systems is that the first ones function as an economy with a fixed or administered exchange rate with reserves to backup legal tender (foreign currency and/or some sort of commodity, like gold). This design facilitates the recruitment of members to the network, since anyone who enters is able to exit whenever he wants, getting the money originally deposited back (on payment of a tax that punishes withdrawals).

Since there is no financial intermediation, CC conform monetary systems with no deposits (and no bank reserves); hence, savings can be lent directly from surplus suppliers to credit demanders. In other words, to perform an economic operation any person can obtain means of payment in two ways: either through direct lending of surplus income from a third party (which, strictly speaking, would be a redistribution), or by creating new money (primary issue or outside money). Insofar there are no incentives to the accumulation of surplus income, almost all income is spent within a given lapse time, and interest rates can be close to zero. The monetary system is now simpler (see figure 2 below).

This means that now ε =0 and, so, Y_t in (2) is larger. As it is obvious, from the other side, to get a similar level of *Y*, a system with no inside money needs a greater primary issue (e_1).

It should be noted that a monetary system is a structure of information on relative balances of members within an exchange community. What distinguishes one system from another are design features, such as the magnitude of aggregate imbalances that will be tolerated (as well as their average duration), the magnitude of the imbalances each member is allowed to have (access to credit, its period), the authority empowered to make such decisions (banks, the community as a whole through any established procedure of social choice), criteria underlying those decisions (rate of ROI / NPV, or, rather, in virtue of values of a different nature –social, ecological, etc.), or what money represents, that is, what is its real reference –the thing– or, put in another way, what kind of support it has (the work of members, a third currency, a commodity, other kind of goods, assets or members' property).

However, the benefits of the analyzed design from the theoretical point of view are particularly qualified when analyzing the economic performance of these subsystems. As it was mentioned, the main objective of these experiences is to ensure local labour. Thus, the effect from the macroeconomic standpoint is limited (Vasconcelos Freire 2011, 126). The fact of not providing large credit amounts is also an important barrier for their expansion. Actually, the largest economic circle, the Swiss WIR, became a bank when administrators decided to offer loans beyond the mere redistribution of surpluses among its members, that is, issuing means of exchange over the amount of open credit balances (creating therefore inside money) (Studer 1998).

3.2 Macroeconomic impact of CCS

The introduction of a CCS has many angles to be analyzed regarding its impact on the market. We mention particularly the effect on spending, interest, inflation and business cycle.

Beginning with the effect on total spending, a complementary currency expands aggregate demand via an increase in the spending multiplier. As noted, by discouraging the storage of surpluses without application, marginal propensity to consume grows, producing an increase in consumption and the use of local labour. That is, income is completely spent (within a given time lapse), so that Say's law is fulfilled within the system.

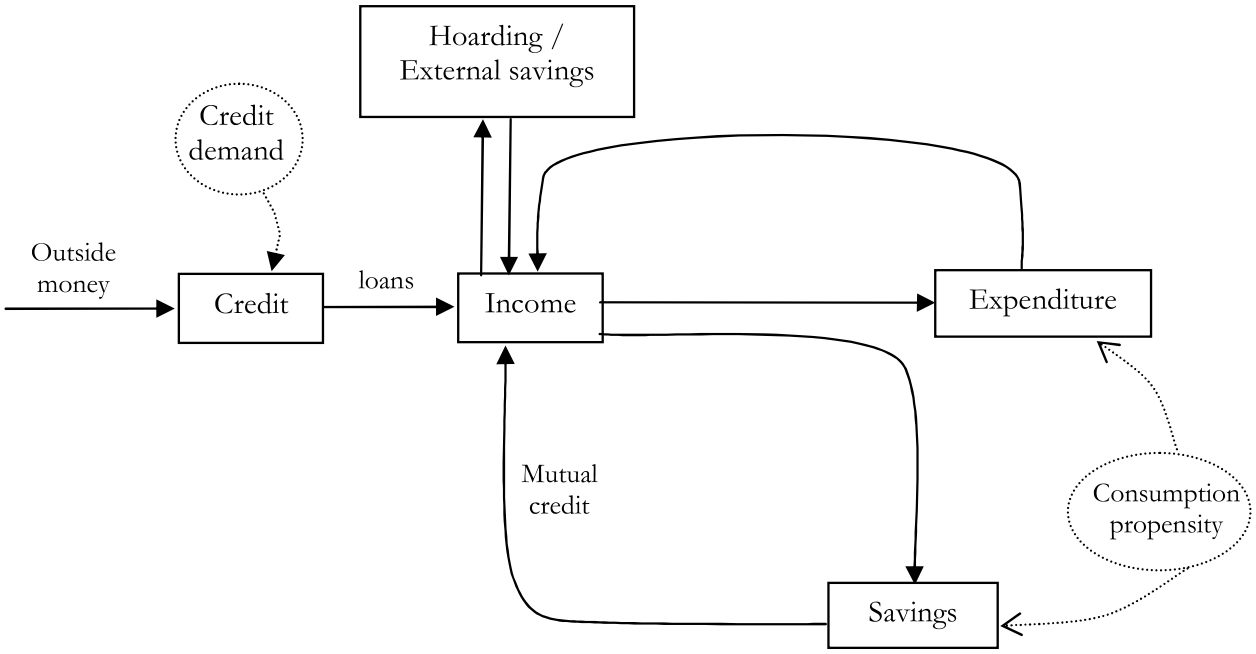


Figure 2. Diagram of money creation in a mutual credit system

Let us see this formally. When a complementary currency is introduced, circulation of legal tender is diminished by the amount of money set aside to support the new monetary subsystem. However, total spending is increased because consumption increases in CC, as this has a lower (aggregate) saving rate than legal tender (or what is the same, a consumption propensity that is on average equal or next to one).

At any moment, deposits (d_i) are a portion α of income (Y). With $\alpha+\beta = 1$ we can express:

$$d_i = \alpha.Y_i^e \qquad (5)$$

where d_i are new deposits made at the moment i, expressed as a proportion α of income (Y)

Now assume that at time k a portion of money in circulation is put aside to support a CC; consequently, spending on legal tender will be reduced on that amount by diminishing the average saving rate (α), as seen below. Being J the number of agents, the average savings rate of the economy is the average saving rate of each member weighted by the proportion between their income and total income.

$$\alpha = \sum_{j=1}^{J} \alpha_j \omega_j \qquad \wedge \qquad \omega_j = \frac{y_j}{Y} \qquad (6)$$

Discriminating two groups depending on the currency used, and defining χ_{jh} as the proportion of expenditure on each currency h for every agent j, weighted by ω_j, savings in k will be defined by:

$$\alpha_k = \alpha_1\chi_1 + \alpha_2\chi_2 \qquad (7)$$

where subscript $h = 1$ indicates the proportion of spending on legal tender, while the value 2 is the spending which uses complementary currency. However, since α_2 tends to zero, given that there is no incentive to the accumulation of savings in the subsystem:

$$\alpha_k < \alpha$$

From then onwards, total expenditure will be done in two currencies:

$$G_{k+l}^{*} = \sum_{n=k+l}^{\infty} g_n + \frac{P_m}{P_\mu} \sum_{n=k+l}^{\infty} \gamma_n \qquad (8)$$

being γ the expenditure done in complementary currency, and P_m/P_μ the relationship of price indexes in each system (legal tender and complementary currency, respectively), which operates as a converter for purchase power parity or real exchange rate. It is expected that $P_m/P_\mu \geq 1$, given that complementary currency has a limited scope.

On the other hand, the effect in time of the money multiplier will condition expenditure (Y) through the following expression:

$$G = \sum_{t=1}^{\infty} g_t = e_1 \sum_{t=1}^{\infty} (1-\varepsilon)^{t-1} \tag{9}$$

So that, if in moment *k* a complementary currency is introduced, the previous expression can be split in two periods, and expenditure in legal tender will be conditioned by:

$$\begin{aligned} G &= \sum_{t=1}^{k} g_t + \sum_{t=k+1}^{\infty} g_t \\ &= e_1 \sum_{t=1}^{k} (1-\varepsilon)^{t-1} + \left[e_1 \sum_{t=1}^{k} (1-\varepsilon)^{t-1} - \gamma_k \right] \sum_{t=k+1}^{\infty} (1-\varepsilon)^{t-1} \\ &= e_1 \sum_{t=1}^{k} (1-\varepsilon)^{t-1} \left[1 + (1-\psi_k) \sum_{t=k+1}^{\infty} (1-\varepsilon)^{t-1} \right] \end{aligned} \tag{10}$$

where ψ_k is the weight of the money reserved as support in terms of expenditure till time k:

$$\psi_k = \frac{\gamma_k}{e_1 \sum_{t=1}^{k} (1-\varepsilon)^{t-1}} \tag{11}$$

so that at time *k* a decrease (γ_k) of the amounts object of the recurrence is produced. It should be remembered, however, that in this simplified model, we are not accounting for loan cancellations. Plainly, this flux would appear subtracting in the denominator, so that the real impact (in monetary terms) of the introduction of a CC in an economy would be higher than the one represented by this formula.

Then, in any cycle subsequent to *k* income will be:

$$Y_{k+l,h=1} = G_{k+l,h=1} = g_{k+l} \frac{1}{\alpha_1} \text{ with } g_{k+l} = (1-\psi_k).g_k.(1-\varepsilon) \tag{12}$$

Analogously, for activity done in complementary currency:

$$Y_{k+l,h=2} = \Gamma_{k+l,h=2} = \gamma_{k+l} \frac{1}{\alpha_2} \longrightarrow \infty \text{ and } \gamma_{k+1} = \psi_k.g_k(1-\varepsilon) \tag{13}$$

since α_2 tends to zero within the CC subsystem. However, from the period k+2, γ does not lose the portion reserved as backup, so that:

$$\gamma_{k+1+l} = \psi_k . \gamma_{k+1} \tag{14}$$

Thus, under a bi-monetary system with CC, total spending (or income, Y) is (in short term) higher than the one which occurs under pure capitalist system because of the increase in the propensity to consume.

As can be deduced, introducing a CC operates as a decrease in rates of interest via the reduction of the relative weight of interests paid in relation to expenditure, since interest rate is i= Interest amount/Y, and, as was argued, Y=G<G*. Thus, the greater number of transactions initiated in the same original loan (due to increase in the multiplier) results in a reduction of the average amounts paid as interest related to spending or, what is the same thing, that spending has a higher degree of leverage in terms of central bank's monetary base.

This conclusion can be understood from the opposite side if CCS are considered as a scheme of cooperative vertical integration. In this sense, Van Arkel, director of STRO, mentions an interesting example. Assume that McDonald's was disjointed between all its stages, that is, production of inputs, products, services, franchising, in so many sub companies as departments exist. Every small business must then obtain their own financing for their investments, for working capital and even to establish contingency reserves (paying an interest rate on loans), because it must pay its suppliers with money what before was done by an internal compensation system. The tasks performed and products offered are the same as before, but now they pay a much higher financial cost, which eventually end up reducing the product level.

It is worth asking what happens when currency suffers from a high rate of inflation. In such a case the reserve that supports complementary currency will suffer a loss in its value, so that it will also operate as a disincentive to get out of the network. However, such a situation would modify price relation against local system, sparking forces that would offset that effect –via "leakage" or "capital flight", equivalent to devaluation (Pfjajfar et. al. 2012). While currency exchange between local currency and legal tender is generally discouraged (or even prohibited), this practice is all but inevitable if the trading community is large, so that systems end up functioning as a quite flexible exchange rate scheme. These networks encourage further participants to perform their trade in local currency by 100%. However, neither this advice may be made effective by coercion, so that is one of their weak points (Studer 1998).

CCS can also perform financial transactions beyond the task of offsetting debits and credits. If so, they can create money by lending. This is what WIR Bank, of Switzerland, does. This bank was born in 1934 as a consumer circle

starting in 1952 to issue additional currency loans, and charging a modest interest (around 2%) to cover loan losses (Studer 1998). In that year, WIR Bank renounced charging credit balances (known as demurrage), a Gesell's idea which aimed at discouraging hoarding. Currently (2013), the maximum ratio of interest charged by WIR is 1,8% for medium term deposits (see: www.wir.ch) WIR brings together Swiss SMEs. Stodder (2009) found that the evolution of activity in WIR currency has a statistically significant countercyclical behaviour (at least until 1974), what may be and evidence of the role that CCS perform, cushioning external shocks by a partial and virtual closure of the economy, protecting internal labour. This feature is perhaps the main attraction of these experiences.

The same occurs, however, when macroeconomic cycle runs through an expansionary phase. Then circuit activity slows down or enters directly into a dormant state. That might be occurring presently with "Circuito Compras" developed by the Social Trade Organisation (STRO) in Porto Alegre. The enormous growth Brazil showed in the first decade of XXI century determined that virtually no transactions were recorded over last years.

In any case, it is remarkable that complementary currencies may operate as countercyclical devices that virtually close the economy (through institutional, non-discretionary, means) when it faces the onslaught of external constraints or shocks. The great barrier that such systems must overcome is in any case the necessity to reach such a volume that demand of goods is met within the same network.

Finally, it should be noticed that the main feature of private currencies (also called "quasi-currencies", because of its lack of general acceptance) is providing what in terms of Gresham's law is "bad money", because they do not serve as a store of value. As noted by Gesell (1916), the virtue of "bad" money is that it has greater circulation than the "good" one, therefore enhancing economic activity and avoiding recurrent crises motivated in under consumption.

4. STRO C3. THE EXPERIENCE OF PUNTO TRANSACCIONES (PT)

4.1 General features

Some of these features were implemented by STRO in its C3 systems. A C3 system aims to integrating commercial credit from providers by implementing a network of electronic currency payments. For this purpose, STRO developed the software Cyclos which links all network members' balances, facilitating the circulation of income and operating as real-time clearinghouse. The system allows making payments via mobile phones or Posnet, so that it meets the mentioned characteristics.

Properly, C3 device integrates into a unique exchange system commercial credit (hence its name, Commercial Credit Circuit, C3) or credit from providers, usual in our economies, so to convert those credits into transferable rights circulating among network members, in the way a check is endorsed. Given that it does not receive deposits nor offers loans from such deposits, it is excluded from Bank Act.

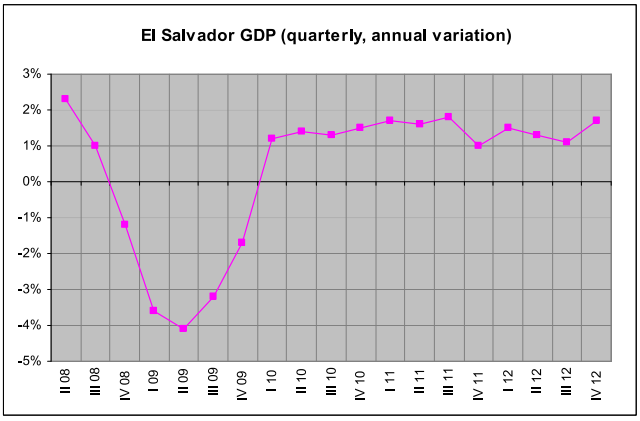
The system gives members the opportunity to have a guaranteed minimum demand for their products or offer discounts to customers outside the network, using partial payment in C3 currency, thus maximizing the use of local labor. This situation is clearly seen if it is remembered that complementary currency cannot be used to import or as a store of value.

Though there is no standard form of C3 system, currently there exist circuits of this type implemented in El Salvador (Punto Transacciones), Honduras (Red Suchitoto, where notes are used) and Porto Alegre, Brazil (Circuito Compras). Overall, members are dedicated to trade and service activities. In the following paragraphs, we will concentrate on the Punto Transacciones (PT) case.

Punto Transacciones is a kind of barter or CC system that works through Internet. It began operating in 2008 in the area of San Salvador. The network was set up in order to strengthen small enterprises in El Salvador. These firms suffered from a lack of working capital and at the same time they had a production capacity which they could completely sell off.

The methodology was based on an analysis of different networks in Latin America and Europe and with new insights from the Dutch foundation STRO it was adapted for small businesses in El Salvador.

In the following years most small businesses associated were running out of cash due to a sharp decrease in sales as a consequence of the overall economic crisis (see Figure 3). Their cash flow situation deteriorated rapidly and they could not get more credit from the banks. Through this system, though, several companies could get the extra working capital needed.



Source: http://www.tradingeconomics.com, Banco Central de Reserva de El Salvador

Figure 3. El Salvador GDP (quarterly, annual variations)

At the end of 2012, PT had about 500 companies and a hundred of individual consumers affiliated, operations having generated the equivalent of nearly $ 2.2 million in the year. The number of members grows steadily in a linear fashion (Figure 4), as a result of a moderation of the rate of affiliation of businesses in 2012, and a greater rate of individual memberships from 2011 onwards (Figure 5). While the system still fails to cover operating costs, projections indicate that in 2013 would become self-sustaining.

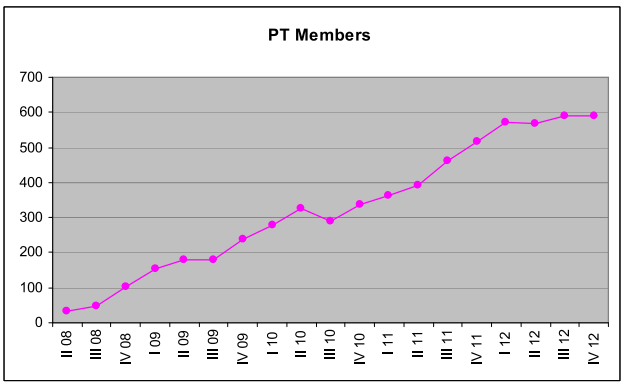


Figure 4. PT members

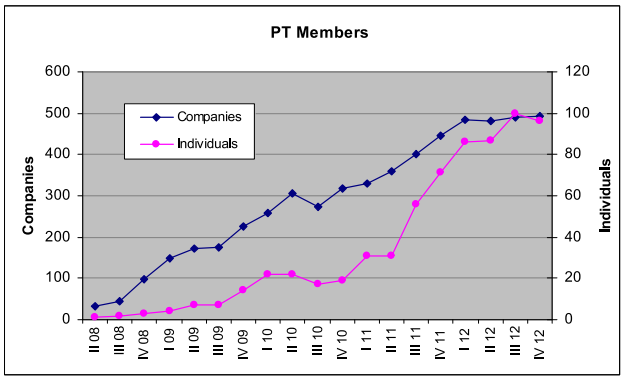


Figure 5. PT members, individuals and companies

In 2012, a survey between entrepreneurs found that 60% had a significant increase in sales (34% said it did a little bit) and about 70% had financed operations with complementary currency.

Other information collected from the system database is equally eloquent.

If we analyze the evolution of the system in these early years, it can be seen that, even though 2009 was a year when GDP fell 3.5 points, total turnover within the network grew and continues growing since it was launched in April 2008 (Figure 6).

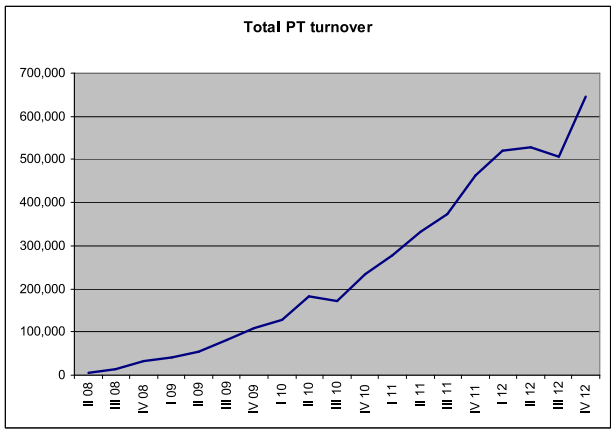
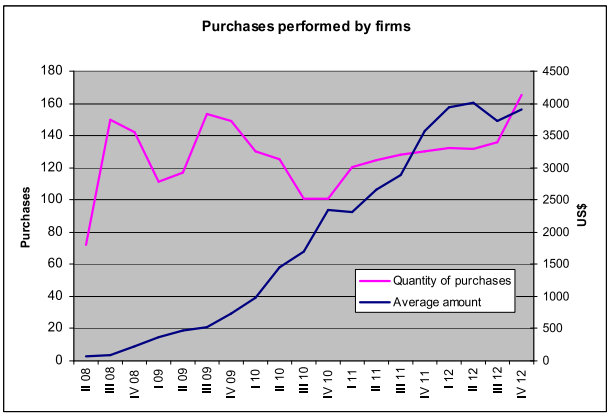


Figure 6. Total PT turnover

This increase is due to a remarkable increase in the number of transactions, but also to an increment in the average value of purchases made within the network, particularly from companies, which are responsible for 80% of the operations within the network (Figure 7).



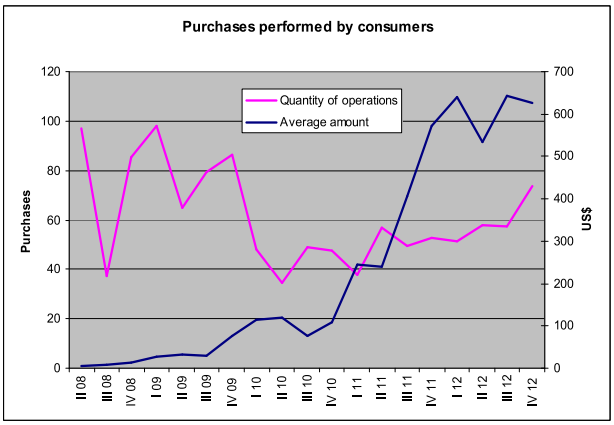
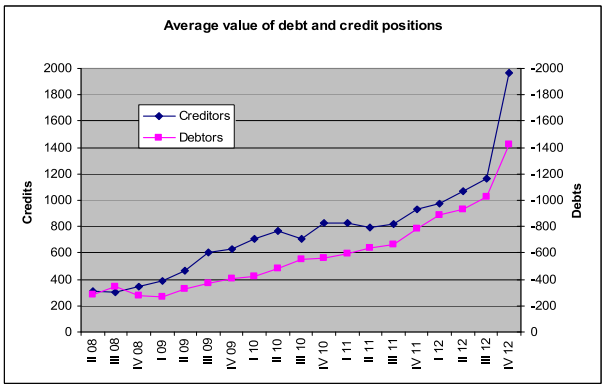


Figure 7. Purchases in PT by firm and consumers

The average value of the debit and credit balances presents a slight difference in favor of the latter, which is offset by the greater number of members with a debit balance.

In order to tackle with the possibility that members with credit balances maintained this situation in virtue of not finding the goods and services they need within the network, the administration holds a cash fund, conformed by units paid in cash. The cash is used to buy goods outside the network and sell them to members with a high credit balance in units. By August 2012, the fund amounted to $35,000.



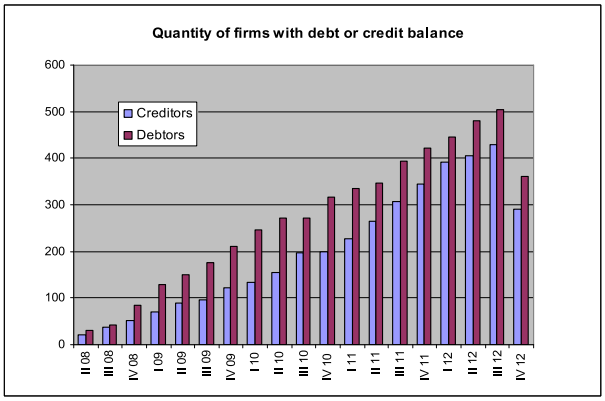


Figure 8. Firms with debit or credit balance, value and quantity

It is also worth noting a slight increase of debit positions with respect to total turnover along these years. Nevertheless, except in 2011, when there were recruited many new members, it can be seen that by the end of every year, or in the first quarter of the following (like in 2010), members with a debit result tend to clear their positions (Figure 9). However, this growing trend can be noticed even if unspent balances by quarter are divided by the number of members (Figure 10). This means that over time PT network has expanded the average balance to be spent by each member within the network. Should this trend continue going, administrators would have to intervene allowing, for example, mutual loans charged with a modest interest (today there are no interests or charges paid on credit or debit balances), so that those with credit balances lend their surpluses to those who demand extra credit, thus moderating the rate of new issues and preventing the risk of a broad increment in prices due to over-issue. Anyway, it should be stated that current situation is biased by the fact that the network is still going through its initial and expansionary phase. In a maximizing efficiency system, criteria to define the amount of open unbalanced positions ("transactions demand for money", in Keynesian terms) should be in proportion (in the limit, identical) to the total amount exchanged in a given period (for example, a day, a month, etc.)

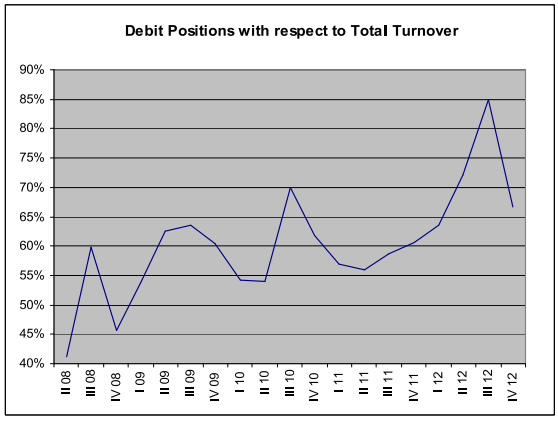


Figure 9. Debt position with respect to total turnover

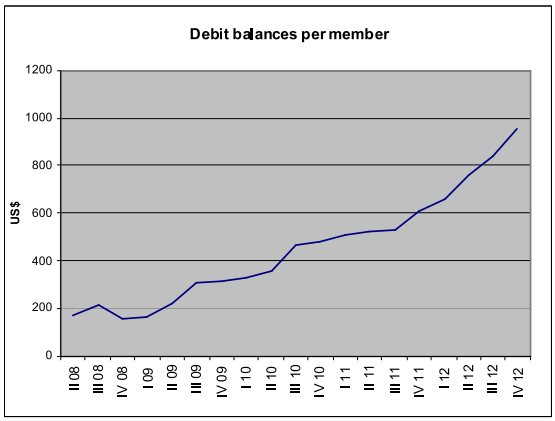


Figure 10. Debt balance per member

In sum, while this data must be followed closely by administrators, it is needed extra information and a more extensive series to draw any definite conclusion.

On this regard, it should also be taken into account that the price system reflects the relative supplies of goods and services within an exchange community in a given period. Hence, to the extent that the supply of goods and services within the network do not replicate the proportion verified in the official market, relative prices within the network should be different. But, in that case, those with an adverse price ratio will tend to arbitrate buying and selling outside the network its inputs and goods produced with the benefit of a lower financial cost within the network. These are the "candidates" to maintain open credit balances.

On the other hand, it is interesting to note the evolution of the number of customers per firm. From what is stated above, it is evident that a mutual credit network can only be sustained if there is a well-established economic interaction among members. In this sense, we see in Punto Transacciones a quiet linear increase, quarter after quarter, in the number of customers per firm. However, this increase is mainly driven by a limited number of companies, which is manifested in a high maximum number of clients reached by some firms (70), but growing standard deviations of the series and low median for the distribution (9), indicating that there is still a significant margin to grow further in this sense.

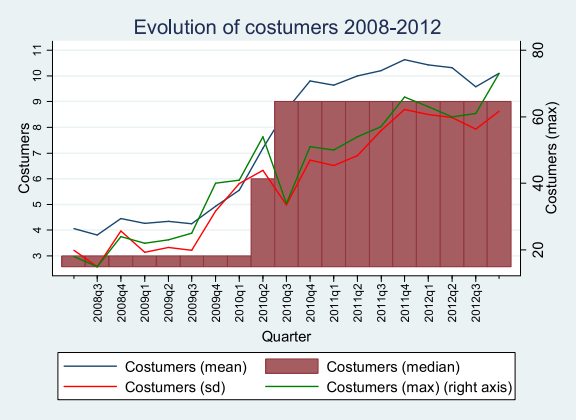


Figure 11. Statistics of number of clients by firm

Concerning the channels used for operations, there is a growing trend in the usage of SMS and Posnet, in a context where transactions via web predominate. This increase is noticeable in consumer purchases by non-members.

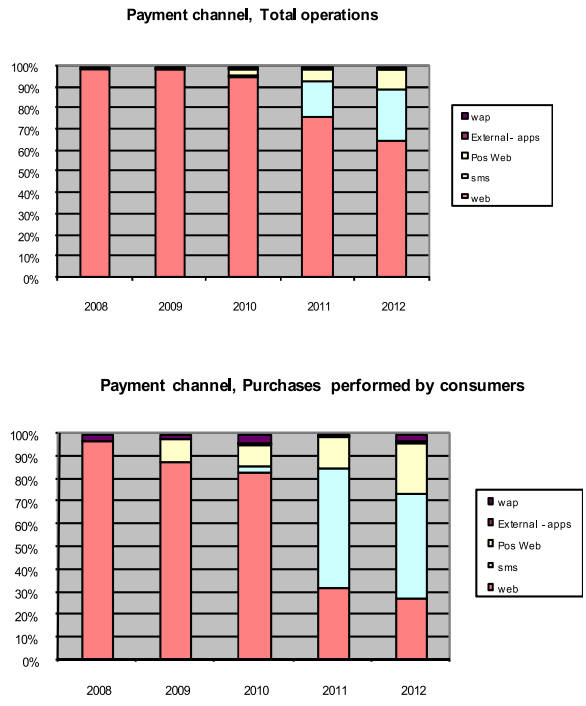


Figure 12. Channels of payment

If data is analyzed by sector of activity, the bulk of members is distributed between professional services (mainly, publicity, health services and computer technical service), hotels and restaurants, and industry (automotive, graphic, textile and office supplies). In July 2012, the distribution of the amounts exchanged by category of activity and buyer (debtor) or seller (creditor) position was as follows:

Sector of activity	As buyer	As seller
Construction	3.0%	2.6%
Industry	12.6%	10.9%
Commerce	9.8%	8.8%
Hotels and restaurants	18.5%	15.8%
Turism	0.4%	0.6%
Education	1.0%	1.0%
Professional Services	22.5%	21.0%
Buseness Services	8.6%	7.1%
Non Profit Org.	0.3%	0.3%
Consumers	5.6%	6.1%
Punto Trans	10.2%	18.7%
N/D	7.5%	7.0%

Author's elaboration on the database of PTrans

Table 1. Distribution of traded volumes in PT, by sector of activity, 2012 (until July)

Finally, it is worth noting that the appeal of complementary currencies is that El Salvador has a dollarized economy, so it lacks the possibility of doing any monetary policy in case of an external constraint.

4.2 The spending multiplier within PT network

As it was stated, the main benefit of a CC is its power to cushion external shocks on a community. This goal is achieved since a local currency cannot be used to transact outside the community. In the second section we have seen how the spending multiplier would be increased from a theoretical point of view, given that there are no incentives to hoarding. In this paragraph we expose a preliminary calculus of the spending multiplier within PT network following a dynamic method. It was calculated through a computer program developed ad hoc. Punto Transacciones database registers every transaction made, offering a lot of information such as buyer and seller ID, amount of the operation, characteristics of members, etc. (for more details, see Appendix.)

It was calculated the final amount transacted from each credit issue, the consequent value of the spending multiplier, the number of transactions involved and the time lapse until the original debt is redeemed. Note that, as was explained, a same transaction may be included in several circuits when the buyer uses his credit balance partially. Unfinished circuits, that is, credits that were not totally redeemed (so that they are still generating income within the network), were excluded from the calculus so as to

avoid a downward bias. The total number of circuits analyzed is 5320.

The distributional data of these variables is the following:

Percentiles	Original amount	Multiplied amount	Multiplier	Transactions	Duration (days)
1%	0.4	0.4	1	1	0
5%	1.1	1.2	1	1	21
10%	2.0	2.3	1	1	53
25%	6.4	8.4	1	1	131
50%	28.2	49.5	1	1	317
75%	99.2	384.9	2.1	2	596.5
90%	280.5	11,443.6	131.5	243.5	820
95%	470.1	25,956.2	424.2	542.5	940
99%	1,478.4	73,136.8	3,482	1,406	1,151
Mean	**119.1**	**4,352.7**	**191.5**	**88.2**	**386.3**
Std. Dev.	342.7	16,454.3	2,410	313.1	294

Table 2. Distribution data of variables related to the spending multiplier

The average amount of transactions is equivalent to US$ 119.1, and the average multiplied amount, of US$ 4,353. This yields an average spending multiplier of 191.5. Anyway, this value is equivocal, since the distribution is far from being a normal one. That is, transactions are accumulated in the left tail of the distribution. This can be seen in the previous table since it shows that the median of the number of transactions or the multiplier value is 1, what means that a half of credit issuances are not multiplied. They are cancelled out by a sale of a greater amount than the original debt after new credits have been emitted.

If we exclude non-multiplied credits, so that the exposition of data is not biased by extreme values, the distribution of frequencies of the spending multiplier takes the following form (values truncated at 100):

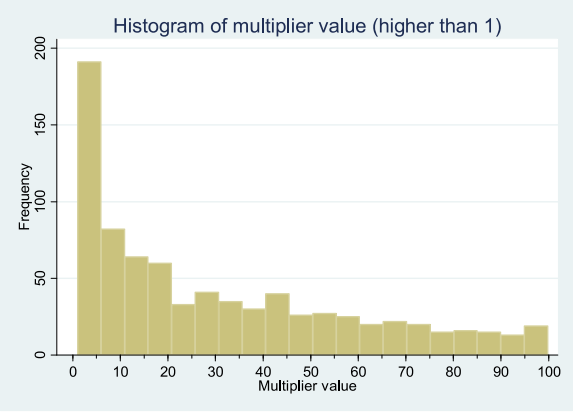


Figure 13. Histogram of multiplier value

4.3 On the comparison of DPS and legal tender multipliers

It is important to remark that the kind of analysis performed here (the first of this type, as far as we are aware of) can be carried out because of the utilization of electronic money. In consequence, it is hardly possible to compare these results with the performance of legal tender market, since estimates of the velocity of circulation in this market in a strict, disaggregate and dynamic fashion cannot be made due to the lack of information. We haven't got a track of the circuit any original issue performs. Usually, estimates of the spending multiplier are made departing from estimates of consumption propensity. Another possibility is to relate Gross Production Value to money issued or monetary liabilities. However, these methods do not take into account the time lapse the circuit takes to complete its round. They are static estimates.

Actually, time is variable within transactions and has a decisive impact on results. The distribution of the duration of each circuit (including their successive branches) is shown in the following graph:

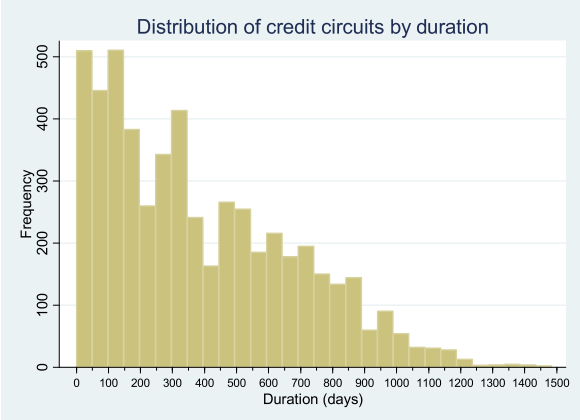


Figure 14. Distribution of credit circuits by duration

Regarding the method to implement any comparison, there are still other obstacles to be overcome. On the one side, we lack estimates of added value within PT network, but, on the other, though there are available updated estimates of Salvadorian GDP there are not updated figures of aggregate gross production value (GPV). The most recent number is from 2005 Economic Census. Our estimates will, then, use the ratio between GPV/GDP in that source, to get an estimate of GPV from 2008 to 2012. Though these results may be biased, we do not need an accurate estimate but just an idea of the order of magnitude of the velocity of circulation.

Once we have our GPV estimate, we proceed to relate it to money. In this concern, there is also another remark that should be done. As it was explained, in official market money is issued in a two-stage process. Since within PT network there is no inside money, we will compare GPV with both cash and M2 (which includes cash, current account, saving and time deposits). Actually, the second op-

tion is more accurate, since the first one includes not only spending0, but also money multiplier.

Besides, total turnover within PT network neither is strictly comparable with GPV, since PT network does not include the totality of stages of every value chain, nor does it include critical braches of Salvadorian economy, like Agricultural sector, or, by its very definition, financial sector. Besides, data of final or intermediate "import" goods and services (that is, produced in the official market but sold within PT network) is not available in the database. Finally, the fact that the network is still in its expansion years would be another source of noise. The results are as follow (figures in millions):

Year	GPV	Money supply (M2)	Spending Multiplier	Cash	Spending Multiplier
2008	48,220	8,247.19	5.8	1,662	29.0
2009	46,487	8,317.16	5.6	1,775	26.2
2010	48,191	8,615.16	5.6	2,134	22.6
2011	51,964	8,644.08	6.0	2,382	21.8
2012	53,520	8,741.27	6.1	2,467	21.7

Source: author's estimates based on Salvadorian Central Bank of Reserves data (Ingreso Nacional Disponible and Panorama monetario) and 2005 Economic Census.

Table 3. Salvadorian Economy: spending multiplier estimates

As it was noted, several conditions restrict the comparison between the spending multiplier calculated through both different methods, within PT network and in legal tender market, respectively. Anyhow, the results exposed show some evidence in favor of the thesis sustained along this work, that complementary currencies enhance circulation of money compared with legal tender market.

However, these results should be taken prudently and more research is needed to draw definite conclusions. As it was shown, there is a significant amount of debit open balances within PT network (and even a growing trend in these first expansion years if they are related to total turnover). This means that there are many transactions that are not computed in the dynamic method of calculus, since it only takes into account cancelled circuits, which would be actually included if the static estimate was used.

5. CONCLUSIONS

Complementary currencies may be a useful tool for local development, in so far as they generate an augment of the demand multiplier. The creation and maintenance of such systems, however, is not exempt from difficulties. Anyhow, the development of new technologies is greatly facilitating their development. The ease of access to the means of exchange can be of great importance for development, particularly its effect on reducing interest rates.

Maybe, under the current context of global economic recession, with interest rates close to zero, the benefits of these systems do not seem so manifest. Nevertheless, the fact of having a direct link with the real economy and of limiting financial complexity through successive leverages provides a guarantee against volatility and even helps central bank policy by its expansionary effect on aggregate demand. In part this situation is currently being experienced by global economy: with minimum interest rates, speculation opportunities are reduced, and with them the chains of leverage that are permanent source of systemic risk. However, the liquidity-trap context of central economies prevents aggregate demand from reacting to monetary impulses. Perhaps it's time for complementary currencies? As seen in Longhurst and Seyfang (2011), they are an alternative that many communities find to protect local labour from adverse effects which are not their responsibility, but which they suffer as victims.

In this respect, the case of Punto Transacciones, in El Salvador, seems to be illustrating several of the facts previewed by theory. Activity within the network increases in spite of the low growth (or even the retraction) experienced by Salvadorian economy, small companies access to cheap credit, and so they see how their sales grow, etc.

From a macroeconomic standpoint, a CCS boosts the spending multiplier, which means that the use of local labour will be maximized. To get a clear explanation of this feature was the goal of the present paper. Certain evidence that supports what theory predicts was also exposed by calculating the spending multiplier in Punto Transacciones barter network and comparing it with an estimate of official money multiplier.

In times when local communities are being shocked by the sudden gusts of capital movements, complementary currencies appear to be a feasible defence at hand.

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