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Network Analysis and Management of the Hudson Valley Current

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Abstract

Our paper discusses the architecture of the Hudson Valley Current (HVC), and maps its small but growing local complementary currency, the *Current*. Established in July 2013, the HVC is both a clearing house for its members and an issuer of currency in its own right. The HVC uses *Currents* to finance its own operations and support non-profit businesses and events in the area. This expenditure by the exchange can be considered "sound" because HVC owns and operates a free local magazine with 20,000 readers and redeems its local currency for advertising. This business centric model of currency issuance allows the HVC to pursue social goals and promote new network connections amongst members. We are adopting tools that will help us manage our network better and increase currency circulation and social impact for the broader local community.

Keywords

Local currency, Network Analysis, Hudson Valley

1. Introduction

Located 160 kilometers north of New York City, on the Hudson River, is the headquarters of the Hudson Valley Current (HVC) in Kingston, New York, which promotes and operates a local complementary currency called the *Current*. Our paper discusses the interesting architecture of the HVC which is a hybrid of forms. It is mutual credit pool where members can issue credits to in exchange for

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goods. But at the same time the HVC backs its currency with advertising in a local magazine. By allowing businesses to redeem *Currents* for advertising there is an anchor to the value of the local currency. This allows the HVC to actively spend and promote local social causes, and as well drain excess *Currents* from the system by selling advertising. The HVC also promotes additional barter arrangements that go beyond the goods and service pool of its members. By accepting gift cards from non-members for advertising the HVC expands the options for spending by its members.

The layout of our paper is the following. In Section 2 we shall compare two different systems and discuss the idealized components of the pure mutual credit system which relies solely on a money supply that is created in a decentralized and endogenous manner. Section 3 then describes the architecture of the HVC platform and business operations with an emphasis of how money is recycled. Section 4 will give a quick overview of the *Current* membership since its establishment in July 2013. We shall see that active participation in the network is small, around 50 core businesses, non-profits and individuals, annually. Section 5 is a discussion on sectoral imbalances in our network and how sectors are interdependent. This offers a useful way to view the system and consider whether deficit spending is causing unwanted pooling in sectors of the *Current* economy. Section 6 drills down to individual nodes and highlights sources, sinks and spinners in our local currency network. Overall there has been rising participation and trading volume since mid 2017, despite components of the network stagnating. Section 7 offers our conclusions and points towards future research.

2. Mutual Credit vs Single Issuer

Local community currency (LCC) systems today are typically mutual credit systems. A centralized clearing exchange maintains credit and debit records for their members. The exchange does not engage in spending on its own behalf. The Sardex in Sardinia is the best example of these systems. The managers of the platform accept membership fees in Euros to finance their own expenditures, rather than be financed in Sardex. Under mutual credit systems the supply of money (or credit) is tightly regulated and must come endogenously from the users themselves. The power to issue money is decentralized, granted to each member in the system who have goods or services to sell. Since money is created in the exchange for these goods or services it is said to be backed by the community's own productive capacity. It is modeled off the ancient practice of issuing private money through promissory notes which had an expiry date. The I.O.U that was issued would then circulate around between other counterparts, until it was finally extinguished with the original business that issued it on its maturity date. This endogenous life cycle of money—issue, circulate, and redeem—is held to occur best under these systems of mutual credit.

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Another reason for the general preference for mutual credit systems, assuming that money goes through the three cycles, is the presence of “exchange reciprocity.” Reciprocity is a fairness issue that all local complementary currency (LCC) members should take as central to their praxis. Another way to describe this is that each practicing individual has the goal of a mean reverting balances where the mean is zero over time (individuals give what they get). The promise of the mutual credit system is that money is not hoarded but rather it circulates, acting as a medium of exchange. The mutual exchange system has been idealized as providing only “enough” money and not more. The purpose by proponents is for the LCC to act as a veil over production, where it is merely an information system (Greco 2009, 115).

An alternative type of local currency is one that is issued and operated by a single business that spends the currency into existence and redeems it when it is paid in exchange for its business services. This second type of LCC is more characteristic of sovereign governments or municipalities that stamp money with their head of state and claim legal monopoly over its issuance. Taxation is their most effective means of pulling money back out of the economy to manage its supply. *Chartalists* like Abba Lerner (1943), Goodhart (1998) and Wray (2014) argue that taxation is essential to giving value to sovereign fiat currencies which are issued ex nihilo, and to guard against inflation or deflation. At the level of nation state, such money issuance allows the issuer to target depressed areas with spare capacity, or promote communal goals by picking winners. Modern viewpoints that support steering today’s economy towards more sustainable and inclusive growth have become more popular (see Wray (2012) and Mazzucato (2018), but were demonished in the latter half of the 20th century by libertarian economists who supported free markets and opposed government intervention (e.g. Friedman 1993).

Rather than a local government issuing a local currency and offering services for taxes, a centrally located business can also have monopoly issuance over a LCC and offer its services for payment in the LCC. The community would use the currency for trade between themselves, and the business would manage the supply of the currency through its injections (purchases and wage payments) and drainage (sales). An important distinction between these two platforms is that the former is said to have its currency endogenously created in a decentralized manner, while the latter’s currency is centrally issued and with a far greater control over the actual supply of money in the system, and hence it is said to have an exogenously issued money supply.

While many LCCs have a mix between these two different architectures, there has been a rise in the popularity of the pure mutual credit exchange and restricting exchanges from issuing their own money. Often this has been based on a simplified assumption that “too much money chasing too few goods” automatically devalues a currency. (Nicholas Kaldor actually put the causality of this correlation in

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reverse. He argued that because money is primarily endogenous, as prices rise more money is demanded and thus created.)

The HVC is a combination of these two formats. It offers and manages a clearing platform using Cyclos and allows members to endogenously create a digital currency called Currents. In general, members are limited to a negative balance of 300 Currents each. However, extensions of credit lines are made available for non-profits if they are deemed able to repay their debt. There is zero interest, and no fee for becoming a member. In supporting this mutual credit pool HVC offers tax statements for each member for income tax compliance. The HVC also runs and operates a free local magazine called Livelthood, that “promotes the idea of keeping money local, local investing, and vibrant Main Streets.” The magazine has a readership of approximately 20,000 in the area and is a popular advertising place for businesses. Delivery service and advertisements can be purchased at 10% discount to US Dollars if paid for with Currents. About one third of the magazine's advertising revenue is in Currents, one third in dollars, and another third in restaurant/shop gift-cards which are described below. The first and last of these revenues help drain Currents from the mutual credit network. The latter two revenue streams come from non-HVC members who buy advertising in the magazine. In this way the HVC leverages access to a bigger community than just the members of the HVC which is still small in number.

3. The HVC Architecture

Funding for the HVC is in large part due to a grant from the NoVo Foundation, which strives to support thriving local communities. There is an independent board that sets guidelines to HVC operations. The HVC organization really began as a magazine, a popular free publication in Ulster and Dutchess counties that was delivered widely to stores for customers to take for free and find out about classifieds, local happenings and “good news.” The magazine sold advertising to local businesses, which in turn would promote the magazine in their stores. When the CEO, Chris Hewitt, decided to create a local currency and started up the HVC non-profit, he initially kept separate his magazine from the HVC (although the magazine was an important active member in the network). The local currency was launched in July 2013 primarily as a mutual credit pool—with the HVC maintaining the central ledger and acting as the clearing house between members. Since that time the way to enroll to use Currents has remained the same: membership is open to all, free to join, and there is no interest charged on debts or interest payments to creditors. The only real constraint is a 300 debt limit in Currents (there is no limit on the amount of positive positions). The HVC exchange is overseen by a board which has set the rules for its governance. The primary limitation on the HVC is that it has a debt limit half of all the lines of credit aggregated over the members. In January 2016 Hewitt decided to merge the magazine with the HVC.

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This led to an ingenious way for the Current to be officially backed by advertising. Currents are redeemable for advertising in the magazine—a service that the organization has in ample supply.

Here we outline how the three operating accounts of the HVC and how they interact:

A. The HVC Livelihood Magazine

This is a critical and necessary component of the HVC and acts as an important method to drain Currents from the system. The magazine does pay writers in Currents, but most importantly it offers services to HVC members and non-members. The magazine sells advertising to the businesses and individuals for fiat currency, Currents, and non-member restaurant/shop gift cards. These gift cards are passed over to the HVC General Store and sold to HVC members for Currents. There is an elastic supply of advertising for HVC members who pay with Currents, making it an easy way for businesses to redeem Currents.

Advertising sold in Currents has a 10% discount from fiat US Dollar purchases. About one third of the advertising sales are in Currents. Retail stores and restaurants that are not members of the HVC can exchange gift cards for advertising. This option represents about one third of advertising revenues and is an ingenious design element for the HVC (which we shall see below). Gift cards or company scrip are another form of money. The HVC Livelihood Magazine gladly accepts these gift cards which it then sells in its HVC General Store at par to members in exchange for Currents. The issuance of gift cards is similar to each store issuing its own money (e.g. Deli Dollars in Great Barrington 1989). Hence stores that don't yet feel comfortable with accepting Currents from their clientele are still able to participate in the barter experiment with HVC and learn how easy it is to issue their own money.

B. The HVC General Store

This is an operating account, which sells the gift cards back to members, along with other sundry items like t-shirts. It acts as a supplemental drain for Currents from the system along with the HVC Livelihood Magazine account. Not only businesses but now also individuals with positive Current balances can voluntarily exchange or redeem their credits for restaurant gift cards by going to the HVC General Store. This adds a lot of new dining facilities that would not otherwise be accessible to Current users, opening up their choices. While there will be a limited supply of gift cards advertising is effectively unlimited.

C. The HVC Community Account

Like most central bank operations, the HVC General Store and Livelihood Magazine pays its excess Currents over to the Treasury—the HVC Community Account. The Community Account might be seen as the fiscal account, that together with its shell companies, effectively spends its own (printed) money (similar to Modern Monetary Theory). The HVC Community Account pays in Currents a percentage of its office space, marketing, consulting services, and wages.

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It also has a social mission to utilize spare capacity in the local community, not just between businesses and their local supply chain, but in social activities that correspond with community goals. HVC has collaborated with, supported, or extended additional credit lines to the Rondout Valley Growers Association, Family of Woodstock, Ulster Corps, YMCA Farm Project, People's Place, Horses for Change and Mental Health of America. HVC makes donations of dollars and/or Currents to local charity organizations. HVC has had six big events such as Satisfy Hunger, and a local currency art exhibit. There are also social events for members to help them learn more about the Current and partner with their peers.

3.1 Circular Flow of Money

In the Figure below we effectively have 2 different currencies: digital Currents issued by the HVC and its members; and paper Gift Cards issued by non-member Restaurants and Shops. To issue means to go into debt or have a negative balance. There are a handful of non-profit memberships that have a higher line of credit limit than the regular 300 Currents (this includes both the Magazine account and the HVC Community Account). The total limit on for HVC debt is 50% of all member lines of credit. The second currency in our diagram can be considered the gift cards, seen here as privately issued money by stores in payment for advertising at Livelihood Magazine (and any other time they give out gift vouchers to the community). A third currency is on the horizon, as the HVC plans to issue paper notes later this year.

Spending one's own money, or seigniorage, is not only limited to governments. Most central banks and commercial banks also earn profits on their intermediation and they use this currency in paying their employees, rents, etc. These entities also distribute retained earnings to their shareholders. So the fact that the HVC has decided to spend money that it prints is an age old practice of those empowered with such a platform. As a well known American economist, Hyman Minsky, once said, "Everyone can create money, the problem is to get it accepted." The HVC has increasingly moved away from the mutual credit model, which is idealized upon all members having a long run zero balance, towards a more proactive role in promoting local employment. One of its aims is for the currency to stay in circulation until real demand meets real supply of goods and services (full employment). Since the currency is redeemable for advertising, its currency has retained its value and its acceptance and desirability is growing over time.

As money circulates through the economy it flows in a circular fashion: it is created, circulated, and then extinguished; which is a major characterization of a healthy monetary system by most economists (Greco 2009, Lietaer and Belgin 2005).

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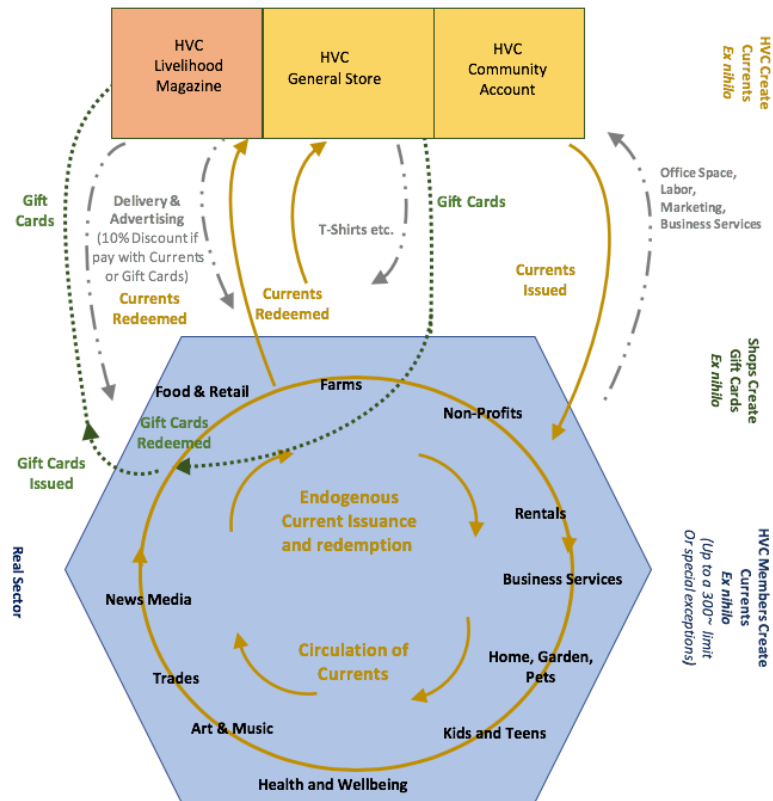


Figure 1 Hudson Valley Current Architecture

4. Location, Membership, and Volume

Around 80% of its members, as of June 2019, reside in Ulster County which has a population of 180,000 people. There is no official restriction on residence for members and so some members who visit the area come as far away as New York City. The towns in the area are relatively small, with Kingston being just over 23, 000 people. Forty four percent of members are located in four towns: Kingston, Accord, Rosendale and New Paltz. Consequently the HVC membership is spread across a large area, which makes it difficult for users to easily connect with other Current members in person-to-person trades. The hope is that as network density rises spending Currents becomes a primary rather than secondary choice, for members.

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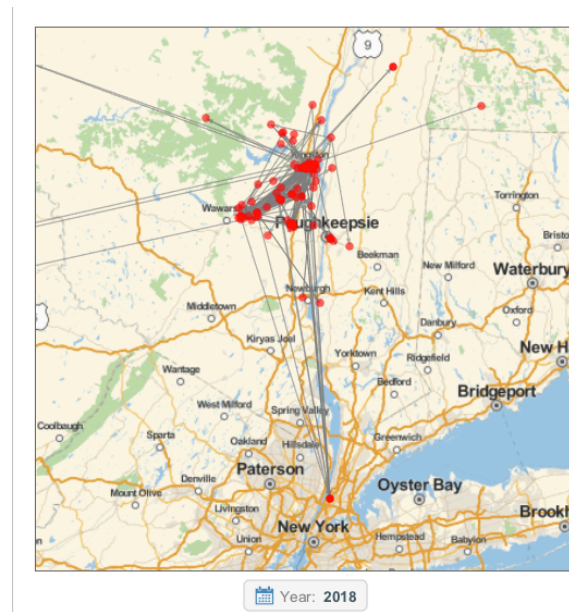


Figure 2 One Month of Transactions

At end June 2019, 366 members were enrolled in the program, however only 226 have activated their account. Of those activated, around 100 members were active in the prior 6 months, as one can see from the green line in the graph below. While 100 members are typically active in a 6 month period, around half of these have actually both bought and sold. By both buying and selling using the Current a member's endogenous creation of Currents is extinguished, fulfilling the money cycle. So we judge that there are around 50 (not necessarily the same 50) members buying and selling in Currents each year, and circulating the currency. Given our open membership, it is very easy for people to sign up, make one or two purchases and then effectively orphan their account. Despite the small size of our local currency community it has been able to leverage a much greater impact through the HVC's charity work, and through recruiting businesses to barter their services with gift cards, and bringing in more production into the network.

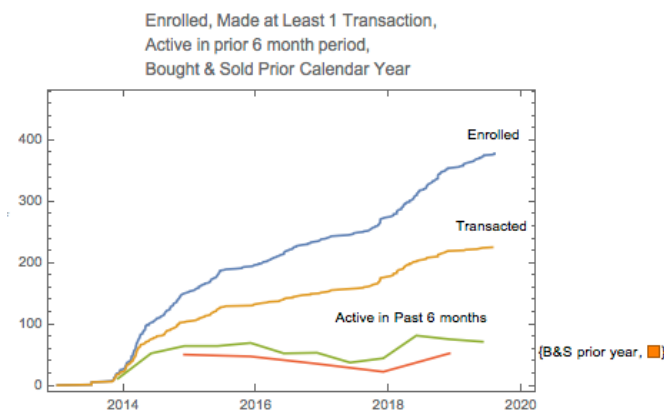


Figure 3 HVC Membership and Participation Levels

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Since its launch in July 2013, over 306 thousand digital Currents have been spent. Quarterly expenditures (equal to quarterly incomes) for the community peaked at the end June 2018 at 40,000 Currents. This rise was in part due to a newly instituted HVC program in the middle of 2018 called the “Heart of Gold program” that allows nonprofits to apply for larger lines of credit if they can show a real expense with a plan for repaying the debt. All applications are reviewed by a Risk Committee made up of board members before requests are approved. In April and May of 2018 2 non-profits had their debt limits expanded from 600 (jointly) to 13,000. The graph below is a plot of total debits and total credits divided into two groups: The HVC System (which is made up of the Livelihood Magazine, the General Store, and the Community Account); and everyone else, which is aggregated and stacked above or below in the lighter shade.

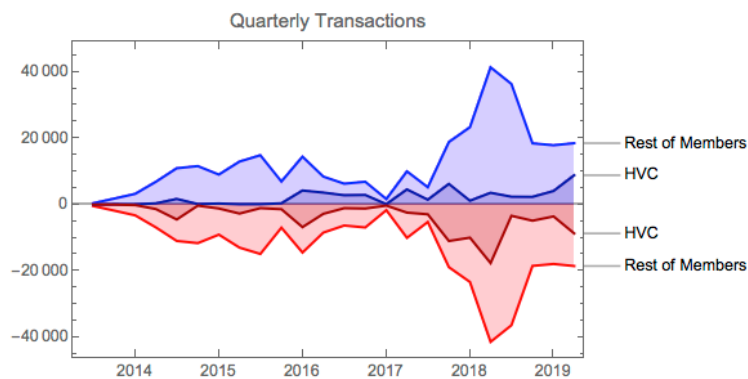


Figure 4 Aggregated Quarterly Transactions: Total Credits and Total Debits

If we look at total expenditures over total debt, the velocity of money has been on a steady decline. At a current velocity measure of 0.3 might infer that for every 30 Currents in the average member’s balance sheet, 10 of these were in circulation. However users are very heterogeneous. Some users are very active, while others have simply stopped participating. In part this is due to the open door policy of membership.

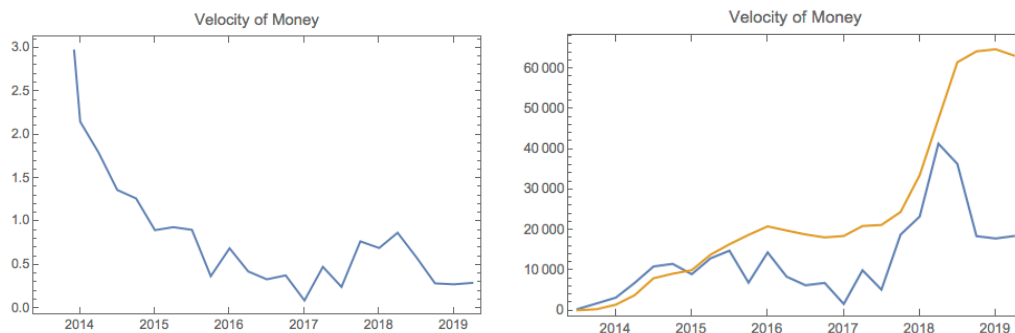


Figure 5 Quarterly Velocity of Money: Aggregate Credit Transactions / Aggregate Debt

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This velocity measure was derived by dividing total purchases (blue in RHS graph) with the stock of total debt (yellow RHS graph). While the money supply (total debt) has been rising, it has tapered off with the growing sales in Gift Coupons. Velocity actually rose during and because of the debt expansion during 2017 and 2018, where Business Services with positive balances were able to keep money in circulation. Participation rates were rising over this period. The figure below shows that the number of unique members participating, the number of transactions, and the size of transactions were all rising. This would indicate that the HVC is not crowding out participation by others.

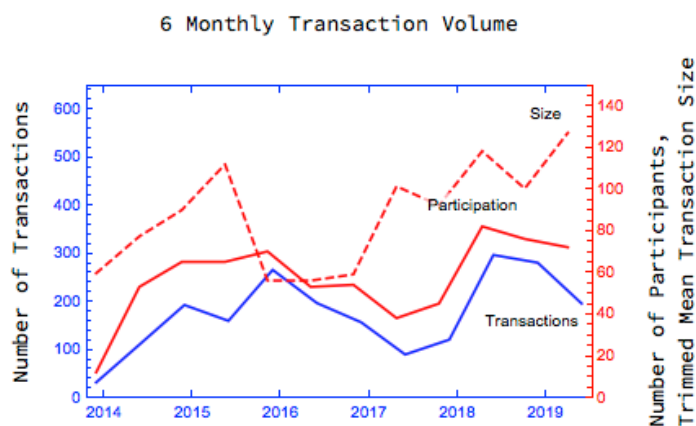


Figure 6 Transaction Volume, Size and Participation

5. Sectoral Imbalances

It is important to ensure that the HVC expenditure is not creating pooling of credit balances. We look at this by sector. We have divided our members into 11 categories with data from July 2013 to June 2019. Apart from the HVC, the group that had the most credits on their books also represented the majority of our membership demographics—Business Services. The next category was Health & Wellbeing services. On the other end of our spectrum, the groups with the most debits was of course the HVC, as well as Non-Profits.

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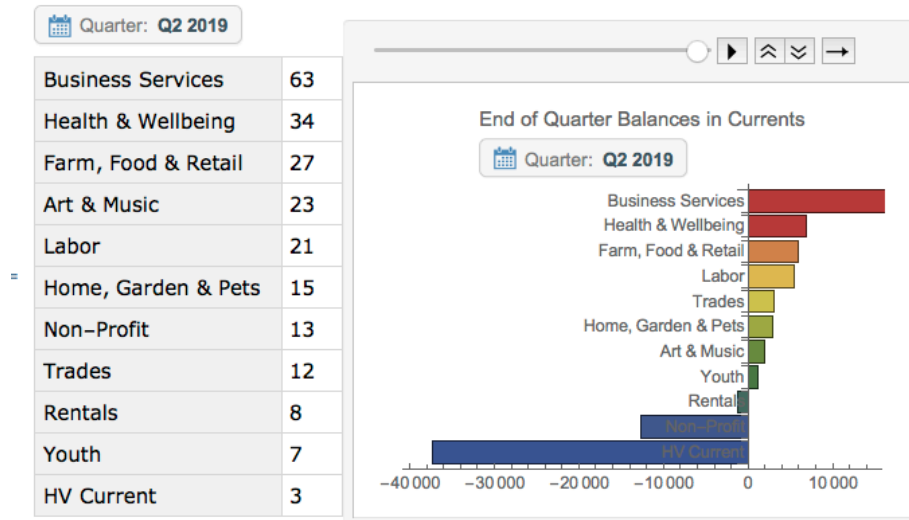


Figure 7 HVC Membership By Sector and Balances at end June 2019.

These categories can be further divided into subcategories that are more descriptive. In terms of the number of membership accounts, the majority are held by those in Business Services who do Consulting and Graphic Design. This is primarily tied to web design and the interfacing of IT with retail sales. A third important area also listed under Business Services are writers who are employed by businesses to give content to their website and they provide stories to the HVC Livelihood Magazine. In the second important area of Health and Wellbeing the bulk of these members are in the subcategory which we call "bodywork", e.g. massage and physical therapy. These two sectors actually have quite a bit of interaction with each other, and have complementary demands and supplies.



Figure 8 The 225 Members by their sub-sector characterization and population weight

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Below are "net" transactions per quarter for the top 4 sectors and the others aggregated into one category called "Other". The graphs contain the same data, although the one on the right is stacked. We have scaled the values by percentage of total *Current* income. These net transactions are flows or change in stocks (rather than stocks as seen in figure 7 above). They are smoothed using a 3 quarter rolling moving average. The sum of these net positions in each period of time by definition sums to zero. Thus every surplus must have a countervailing deficit.

Looking at the deficits and surpluses there is a tendency for a reversion to zero. This is an indication of reciprocity occurring between traders as opposed to growing imbalances. If we assume that HVC spending is exogenous then its decline in expenditures during 2016, seen in Figure 4 above, may have "pushed" employees into a deficit position (employee wages in Currents are mostly paid by HVC) which "pushed" HVC into a surplus (individuals buying gift cards). More research would be required, to fully investigate the actual causation. The HVC and Non-profits began running larger deficits over the end of 2017 and 2018. These deficits led to build ups in the other sectors. A manager of the HVC could use this information to tailor their outlays and target their credit line extensions to Non-profits that purchase services from businesses that have a higher turnover in credits, leading to a bigger multiplier in the Current economy.

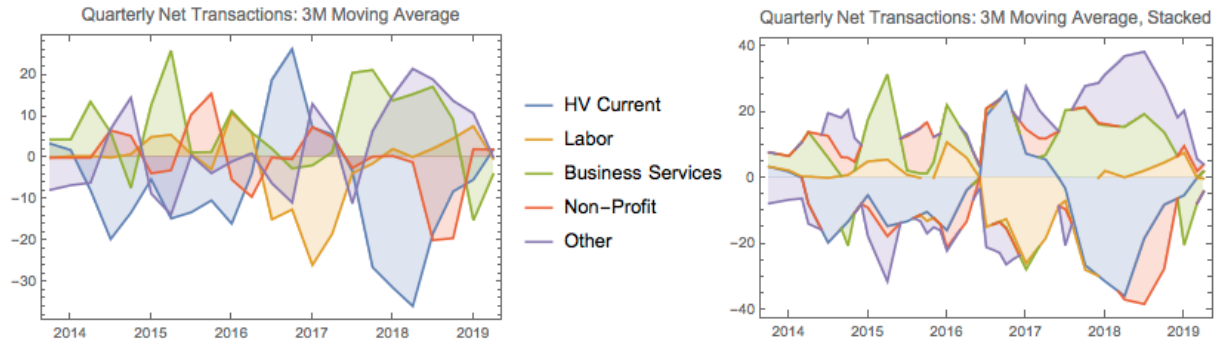


Figure 9 Sectoral Net Transactions: Expenditures - Income

Business Services are well connected to all the other sectors except Youth, Art & Music, and Labor. Its degree of connectivity can be studied and cultivated.

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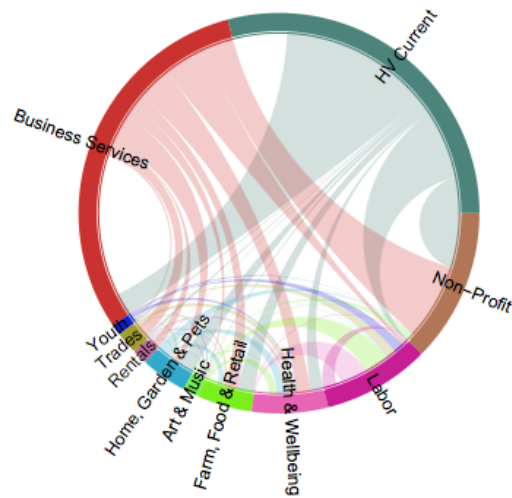


Figure 10 Intersectoral Network of Weighted Links: Purchases and Payments

6. Drilling Down to the Neighborhood and Individual

A lot can be understood once reciprocities (or lack of reciprocity) between sectors, neighborhoods or individuals are understood. Whether one likes it or not, the actions of one person/sector has consequences on the positions and actions of others. In Figure 11 below is an undirect graph of transactions between the 266 participants (all traders) over the entire 6 years. This clustering procedure produced 5 clear neighborhoods.

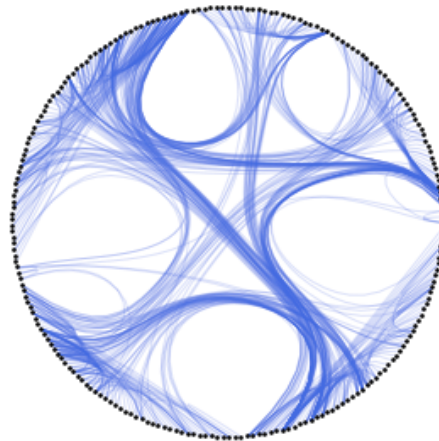


Figure 11 Undirected and unweighted links among 266 Members

Once the direction of the links is taken into account, there may be 7 groups as seen in Figure 12. A more relevant categorization might be done if the clustering is done for narrower time periods. By targeting neighborhoods exchange managers can have more focus when matching buyers and sellers.

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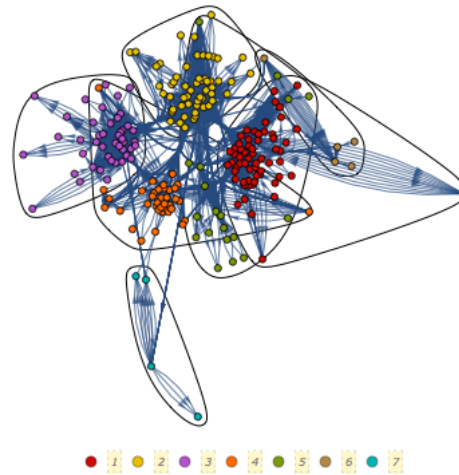


Figure 12 The HVC Community can be divided into 7 Directed Neighborhood Clusters

The 82 members which are not in yellow in Figure 13 are not part of the giant component in yellow. These 82 nodes act solely as drains or issuers for the currency, but they do not circulate it through the network. It is important, in our case, to focus on those traders that help circulate money and reciprocate trade. Managers should convert non-reciprocators into reciprocators.

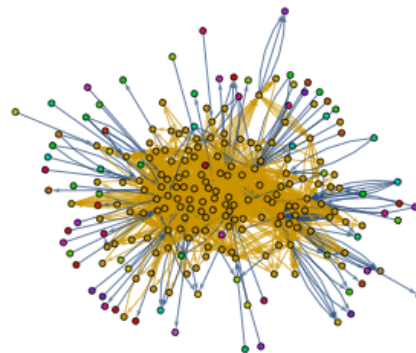


Figure 13 All 226 nodes are joined. 143 nodes make up the Giant Component

By looking at specific years, we can see which nodes belong to which neighborhoods, what the money velocity and multiplier effects are like in those neighborhoods and use this information to target HVC spending and credit line extensions. The figure below is for one specific year where red is for negative balances and blue is for positive balances. By looking at specific time periods, we can adjust for seasonality, or evolution of the neighborhoods over time.

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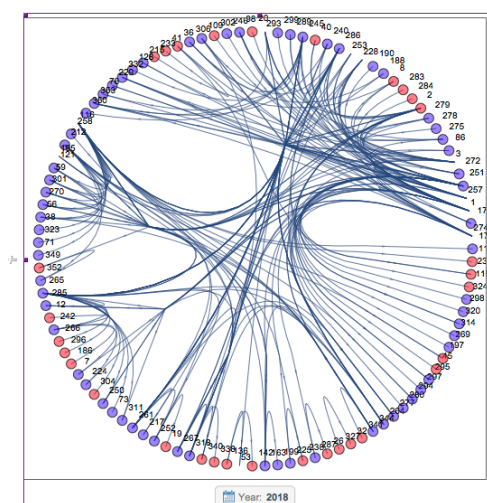


Figure 14 Undirected Network of links between traders in 2018.

Red are debtor nodes and Blue are creditor nodes in aggregate at end 2018.

7. Conclusion

This paper describes the architecture of the HVC platform and its business operations. By designing the exchange as a business the HVC can inject and drain currency from the system. Currently there is a buildup of positive balances among the Business Service members. However this community has spent its Currents in lots of different ways. By distributing their spending they are less likely to push an entire sector into surplus. The Business Service sector has some very active participants that are good at keeping money in circulation. The Business Service surplus is matched by deficit spending by the HVC and the Non-Profit sector. While money velocity has declined over the life of the Current this is mostly due to zombie debtors and creditors who stopped participating. Since mid 2017 there has been an uptick in velocity *Current* membership and transaction volume. While active participation in the network is small, around 50 core businesses, the platform has achieved various social goals, sponsoring non-profits and holding community events. It is believed that HVC spending has increasingly added to money velocity in pockets of the network.

While extending credit lines to more profitable businesses would be a more orthodox action in line with a pure mutual credit pool platform and so-called sustainable money issuance, HVC has chosen to steer the direction of *Current* activity and focus on social investment. This may provide a model for other local currencies that aspire towards more social or environmental goals. Our anecdotal evidence shows that targeted extensions of credit to deficit spending non-profits who direct funds to “spinners” in the Business Services community, can raise money velocity and benefit both non-profits and businesses. By guaranteeing the value of the local currency—backing it with advertising in *Livelihood Magazine*—the HVC gives value to those businesses that have positive positions. While routinely positive, a number of

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businesses are very successful in turning over their positions and recycling money throughout the community. It is clear that there are particular communities which need more assistance in circulating their Currents, and we are hopeful that network analysis might offer some tools for us to do this.

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