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CHIEMGAUER COMPLEMENTARY CURRENCY – CONCEPT, EFFECTS, AND ECONOMETRIC ANALYSIS

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ABSTRACT

Complementary currencies have a wide variety of currency designs. In practice the goals of a community are in the foreground. The form follows not only the function but also the people and the environment. In the light of objectives currency designs can vary. A "pure model" in the beginning, through socio-economic innovation, evolves into a mix of models to find the best matching for capacities and needs based on available resources. When we have a look into established currency schemes like the Chiemgauer in Bavaria, we discover a strong relationship between the economic, social and cultural situation in a country and the development of a complementary currency. We take a deeper look at statistics and also examine pro- and countercyclical effects of the Chiemgauer based on econometric models. Significant impacts on a local level can be assigned. At the next stage, therefore, pilot projects in cooperation with state institutions seem useful, which can contribute as institutional experiments to the democratisation of the monetary system.

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KEYWORDS

Complementary Currencies, Chiemgauer, Quantity Theory, Vector Error Correction Models (VECM), Countercyclical Effects

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1. CONCEPT OF COMPLEMENTARY CURRENCIES

People starting complementary currency think of money as a tool (Kennedy et al., 2012) and are concerned with problems like unemployment, environmental degradation, poverty, inequality, discrimination and so on (Gelleri, 2020b). There are many theories about money and experts who campaign for the concept of complementary monetary institutions.

Before inventing the Chiemgauer, there was a year-long analysis of many different ideas, not only on local level, but also on proposals for changing money and finance on the national level (Gelleri, 2005, 2009). Back in the 1990s there was only little economic literature on complementary currencies, but some literature on barter systems can be found which describes "special purpose money" (Marin and Schnitzer, 2002; Schneider, 1995). However, the arguments remain purely economic - neglecting the social dimension; e.g. enhancing trade between businesses and subject to high transaction costs within an unstable economic system, as it was the case in Russia and Ukraine in 1997.

A broader perspective came with the turn of millennium with papers and books on "complementary currencies" (Blanc, 1998; Gelleri, 2000; Kennedy and Lietaer, 2004; Lietaer, 1999). Lietaer defines a complementary currency as an agreement within a community to use an additional currency in a way of exchange (Lietaer, 1999: 282), while it is complementary, because it is not meant to replace the national currency system.

An anonymous market cannot solve the emergence of complementary currencies but institutions that are setting the rules and processes of creating this new money (Desan, 2017; Ingham, 2004). They enhance the access to knowledge of needs and capacities and possibilities to match them.

Complementary currencies differ from national currencies; they are not or only partially integrated in the official monetary system and have their own currency name and rules. On the one hand, they/complementary currencies differ from 'competitive currencies'. Competitive currencies were created to pursue separate purposes from societal problems and challenges. These include the emphasis on individual ownership of monetary values, anonymity and profit maximisation. A study of Bitcoin shows that an overwhelming share is owned by a small fraction of people and 46% of the transactions serve criminal activities (Foley et al., 2019: 1800). On the other hand complementary currencies aim to be a useful part of society, by taking care of aspects of society that are neglected by the national monetary system (Gelleri, 2020a). The transitions are fluid when complementary currencies substitute other forms of payment ("compete") or when the unit of account or exchange is organized in the national currencies ("integrate") (Blanc, 2018). To emphasize this aspect, many complementary currencies speak of themselves as community currencies (New Economic Foundation, 2015) or community inclusion currencies (Ruddick, 2020). One of the older existing examples of a "community currency" is the Chiemgauer that belongs to the type of "reserve backed complementary currencies" (Gelleri, 2020b).

2. EXAMPLE OF THE CHIEMGAUER COMMUNITY CURRENCY

Our starting point is in the Southeast of Germany – the Chiemgau region between Munich and Salzburg. The Chiemgauer currency began as a school project in 2002. Six students wanted to experience an alternative form of money in a student's project. An action-oriented approach was applied to generate new experience and knowledge. Students (and teachers) wished to learn what money is all about, what it does and how it changes. For this purpose, a non-profit organization was founded as issuer of the local currency in 2003 (Chiemgauer e. V.). This non-profit-organization is in charge of printing the money, education and research, and recruiting new members. At the same time, when the Chiemgauer was founded, Germany was in a recession and the output gap was about 2 per cent (Sachverständigenrat zur Begutachtung der Gesamtwirtschaftlichen Entwicklung, 2018). Real wages had fallen and consumer confidence index was quite low (Lange, 2017). Later we will see why this context is typical for certain types of complementary currencies and generally speaking, there has to be a problem that can be solved by the monetary tool.

2.1 Where does the Chiemgauer idea comes from?

The Chiemgauer was not a completely new idea. In Germany there were already two theories the first movement occurred due to the writings of Silvio Gesell who propagated a monetary system with a circulation incentivized by explicit carrying costs, rather than the inflation of a currency issued by a sovereign (Bongartz, 2015). Gesell never

proposed complementary currencies, but people around him like Hans Timm as a co-founder of the WÄRA (Erfurt, Germany) in 1929, pushed for practical examples (Onken, 1997). The issuer of the WÄRA was based in Erfurt, Germany, and provided communities with promissory notes against secured loans. The initiative disseminated in 14 cities in Germany and was prohibited in October 1931 by an emergency decree. The most prominent realization was the "miracle of Wörgl", a little town in Austria that issued its own currency in 1932 on the initiative of its the mayor Michael Unterguggenberger (Broer, 2013).

The second movement are barter and gift systems which go back to ideas of Robert Owen (Polanyi, 2001: 133). The basic idea of socially mediated reciprocity is much older and is subject of research by anthropologists like David Graeber (Graeber, 2011). Today the WIR-bank in Switzerland is the largest complementary currency in the world (Dubois, 2014). It started in 1934 as cooperative. The founders Werner Zimmermann and Paul Enz were inspired by free money experiments of WÄRA and Wörgl but also by German and Scandinavian compensation funds (Hardraht and Godschalk, 2004). By taking a closer look at the WIR-system you can see it is not only a barter system. It evolved to a "mutual credit banking system" with the cooperative bank as central issuer of the WIR-currency. The issuance is quite like the money creation process of a bank, but unlike the Swiss-Franc, which trades on international currency markets, WIR-Francs circulate only within the WIR-sphere. This system combines the internal cohesion of a barter system with the money creation process of a bank. The WIR-cooperative has the legal status of a bank in Switzerland.

Both examples show that money does not come into the world as a "thing" created by "individuals" but as a common agreement of a collective (Zelizer, 1989). The collective wants to solve a basic problem which Jevons called "the double coincidence of wants" (Menger, 2009). When we find gaps between needs and capacities there is a potential for monetary tools to close that gap. To widen the picture, we also must consider aspects like collective goals or ecological resources. Money is a communication medium to mediate between goals, resources, capacities and needs. "Money, whether we look at its origins in a community or its continuous renewal there, appears as an activity designed to organize a material world." (Desan, 2014: 6)

2.2 Solving the magic triangle

The concept of a "magic square" is widely used to express the goals of macro-economic policymaking (Bofinger, 2010; Picek, 2017). The goals are high employment, permanent growth, price stability and a balanced trade volume with foreign countries. Local currencies define their goals within their community. The main objectives of the Chiemgauer organization are regional development, promoting non-profits, increasing the share of 'gift money' (donations), and sustainability. In the case of output gaps and unemployment the local currency should work as a 'lifeboat' (Kennedy et al., 2012). This objective is similar to the macroeconomic objective of high employment and implicitly include the goals of a price-stable currency and a balance with other currency areas. Regional currencies contain these three goals of the magic square on the one hand, but go beyond them with other goals. At the same time, the objective of "permanent growth" is denied, because exponential growth is seen as a conflict over sustainability (Boit and Hodgson, 2018).

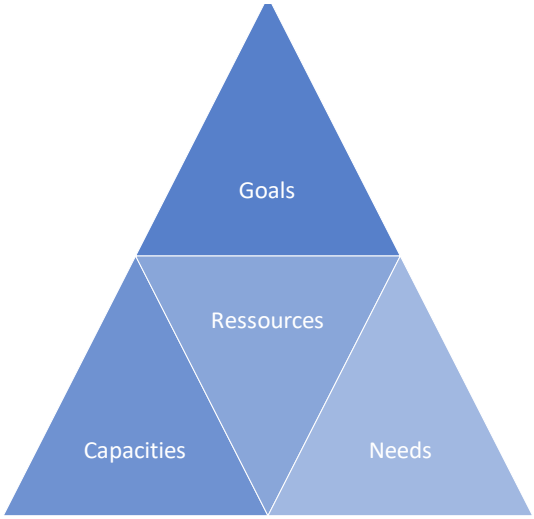
To integrate this conflict into a model, we substitute for the magic square a magical triangle, one that contains the idea of harmonization instead of maximization. We start from resources that the earth provides annually. Then we define the goals that we optimally combine the existing capabilities with the needs (Raworth, 2017). The motto of global thinking and local action can be effectively supported by complementary currencies. In this respect, initiatives such as the Chiemgauer could herald a post-growth society that helps to harmonize planetary boundaries with existing needs and capacities (Paech, 2008).

At the micro level ambitious goals must be transformed into manageable solutions. For the six students in 2002, their main goal was practical: to contribute to a sports hall for the school. Half of the time of gymnastic instruction had been wasted in providing transportation. Many parents and teachers were happy to adopt this goal.

In times of a recession it is often unused capacities that drive the currency innovation. Mutual credit currencies concentrate on matching these capacities to avoid the waste of resources like labor. An example: When person 1 has time, he or she babysits for person 2. Person 2 pays person 1 with one time credit which equals one hour of time. Person 2 can use the time to earn time credits as tutor and so on. This matching is sometimes second-best for the needs of a person or company (Schneider, 1995: 190). But second best is better than no matching at all. The recession in Chiemgau 2002 wasn't very deep but provided arguments for the countercyclical effects of a

complementary currency (Marin and Schnitzer, 2002; Stodder and Lietaer, 2016). In a country like Argentina with a deep recession in 2002, the focus on countercyclical action was absolutely justified (Gomez, 2009). The Credito network was able to help many millions of people secure their livelihood during the collapse of the national currency, the Peso (Colacelli and Blackburn, 2009). There are arguments for establishing complementary currencies in 'good times' as well -- to move the economy toward sustainability, community-building, social justice, resilience and other goals (Lietaer et al., 2012).

Figure 1: Magic economic triangle



Source: Authors' own illustration

The Chiemgauer initiative started with a goal for the school community. Parents and teachers were open for changes in the purchasing behavior (needs) and some small businesses with extra capacity were ready to meet the demand. When capacities are not fully utilized, it makes sense to accept another currency even if transaction costs are higher (Marin and Schnitzer, 2002: 295).

The trust within the school community built up around the Waldorf school enabled the foundation of the Chiemgauer organization. With this background the product of these six students wasn't just a nice piece of paper. It transformed slowly into an accepted institution in the region. In the beginning the trust for the euro system was used as backup. Member businesses had a guarantee that they can change back their Chiemgauer back into euro for 95% of the face value. With the immediate conversion into euro by the students' company, their trust increased. After some time, businesses spent their Chiemgauer again and conversion back to euros became less important. When we look at the proposal of the parallel currency "Ducat" by Hayek we can find some similarities in the process of building trust (Hayek, 1990).

3. THE BASIC MONETARY MODEL OF THE CHIEMGAUER

Today, the Chiemgauer organization is located at Traunstein, Bavaria. Everyone who takes part is member of the Chiemgauer. This basic-democratic approach is a core principle of the project. The members of the organization decide in a democratic process the bylaws and statutes. A board of executive is chosen every two years. Every user of the Chiemgauer has the right to get a vote for the assembly. Members with a vote pay a small annual membership due with extra consideration of small incomes or other reasons so the vote is not dependent on the personal financial situation. The Chiemgauer organization is a limited-liability non-profit set up to organize the distribution of the Chiemgauer. This limited company is democratically controlled by the members of the organization. In addition, there is a data center for local currencies organized as a social cooperative (Regios eG) founded in 2007. The cooperative is also organized based on democratic principles and handles the transactions and accounting of the currency.

The Chiemgauer organizations are owned by the people who use the local currency and only a three-quarter supermajority of single votes would allow the selling to private companies. That's a big difference to private-owned financial service providers or the vast majority of blockchain-currencies which are controlled by the majority of shares. The idea behind is that it doesn't matter if you own one Chiemgauer or 100.000 Chiemgauer, everyone has the same right to speak and to vote. The Chiemgauer is not private property but a common good which is temporarily in the possession of money holders. The "community currency" has to serve both the purpose of the individual possessor and the goals of the community. Therefore, one important principle is that you can possess the Chiemgauer as much as you want but you also have to spend the Chiemgauer within a certain time. Another important principle is that you should spend the Chiemgauer within the community.

3.1 What are the basic rules of the Chiemgauer?

The Chiemgauer organization is obliged to fulfill the aims of the statutes and is not allowed to make profits. Possible surpluses are expended for education, research and development of the Chiemgauer.

The assembly has approved the following basic rules (Chiemgauer e. V., 2012, 2016):

- One Chiemgauer is calculated as one Euro. The relation can be changed in times of high inflation rates of the Euro.
- Businesses have to accept Chiemgauer 1 for 1 in exchange with the Euro. Companies can quote acceptance; e.g., when a heating system is renovated and the payment is done with one quarter in Chiemgauer and three quarters in euro.
- Consumers can exchange euro into Chiemgauer 1 for 1, but they can't change Chiemgauer back into Euro.
- Consumers can choose which non-profit project gets the 3% invoice amount in the Chiemgauer currency. Consumers don't have to pay that 3%.
- Businesses can change Chiemgauer back into euro. There is a charge of 5% plus value added tax (at the time 19 % of the charge) for the exchange – so a total expense of just under 6%. Of that 5%, 3% covers the non-profit project the customer has chosen and 2% is for Chiemgauer expenses. Businesses get an invoice for the 5% plus VAT, but they can deduct the whole amount as a business expense.
- Businesses can also spend their Chiemgauer. All operating expenses can be deducted from income tax and all sales are taxable too. There is no difference in taxation between Euro and Chiemgauer.
- Non-profits get their promotion of 3% in Chiemgauer. They have to spend the Chiemgauer again within the Chiemgauer network. When non-profits have no other possibility, they can choose to accept 2% in Euro as alternative.
- The Chiemgauer has a negative interest rate of 6%. In the electronic version it is calculated daily (6% divided by 365 days = 0.016% per day) but only from the 90th day. The first three months are free. In the paper version of the Chiemgauer stickers are used to prolong the local currency. It costs 3% for half a year.
- The Chiemgauer is valid 3 years after issuance and must be revalued 5 times with 3%. Effective dates are on July 1st and January 1st. The Chiemgauer note below is first valid on November 1st, 2018, the first prolongation had to be on July 1st 2019 and costs three cents. Note that the fee was 8% with quarterly stickers between 2003 and 2015.

When a new Chiemgauer series is printed, the assembly must approve it. So the series itself is a component of the democratic decision-making process.

On the back side of the Chiemgauer is a reference on the statutes of the Chiemgauer organization. It is also clearly stated that non-members have no legal demands against the Chiemgauer organization simply by owning a Chiemgauer. Participants in the Chiemgauer describe themselves as equal but with differences in knowledge and activity (Thiel, 2011: 200). It shows that the Chiemgauer isn't just a means of exchange or neutral medium of communication but a context-sensitive and living collective convention. Trust in the institution is crucial for the participants. Trust is built at different levels: The rule to bind the Chiemgauer on the Euro is the first level. It helps transmit the trust in the Euro into the Chiemgauer system. Reports in media, personal relationships and cooperation with well-known institutions like banks and local authorities establish a second solid level of trust (Thiel, 2011: 277).

Figure 2: Chiemgauer note, © Chiemgauer e. V.

Source: Authors' own illustration

3.2 Chiemgauer in practice

The structure is the framework wherein people can interact with each other and build more trust with each other. The Chiemgauer circle begins with a loan in Chiemgauer or an exchange from Euro into Chiemgauer. More frequent is the exchange transition. In the beginning a local branch of the Waldorf school spread the word with the promise that 3% of every purchase go to the school. Students, parents and teachers were motivated to take part. Other projects followed and did the same. Every person who wants to use Chiemgauer must register. The projects distribute the registration forms. After one week the newly-registered person gets a membership card (Regiocard).

With the Regiocard you can pay directly at participating businesses. The payment procedure is like a credit or debit card payment with PIN-identification. The Chiemgauer software recognizes if the user has a Chiemgauer account or a Euro account. Consumers normally have Euro accounts. With payment the exchange from Euro to Chiemgauer happens automatically. The business gets Chiemgauer on its Chiemgauer account. With the payment procedure 3% of the amount is credited for the non-profit project chosen by the customer.

The principle of the cash Chiemgauer is similar: You go to an issuing office and demand, e.g., one hundred Chiemgauer. The payment procedure is the same as with an electronic payment. The Chiemgauer amount is typed into the card device, the user enters the PIN, one hundred Chiemgauer are handed out, and that amount is withdrawn from the account of the user. The denominations are 1, 2, 5, 10, 20 and 50 Chiemgauer.

The Chiemgauer software automatically withdraws Euro from consumers and Chiemgauer from other Chiemgauer businesses. In case of an exchange from Euro into Chiemgauer 3% of the amount is registered for the project. The user goes shopping with the 100 Chiemgauer. When the amount is 30.54 Euro the user pays 30 Chiemgauer and 54 Cent in Euro. Businesses are not obliged to give exchange in Euro but in practice many are tolerant and handle Chiemgauer like Euro.

Businesses can deposit cash Chiemgauer into their Chiemgauer accounts. They only have to go to one of the 25 issuing offices to cash in the Chiemgauer amount. There are no costs for the Chiemgauer deposit. Only if the Chiemgauer are exchanged back into Euro, the regional contribution rate of 5% plus VAT is due. For 100 Chiemgauer a business gets 94.05 Euro. 3 Euro go to the project, 2 Euro are for operating expenses and 0.95 Euro are paid to the tax office (value added tax). These costs are the incentive for acceptance locations not to change back. The better the logic of the system is understood, the lower are the transactions costs. Businesses spend about two third of their Chiemgauer income again (Christ, 2014: 52). 54% of businesses doesn't convert any Chiemgauer into Euro (Ziegler, 2009: 44).

We can recognize a bonus-malus-system: 3% bonus for a project when you change Euro into the local currency and a handicap of 5% when you change Chiemgauer into Euro. This generates an attraction of funds for the region. Non-profit-organizations (NPO) are the biggest winners in the system with an accumulated benefit of about 740,000 euro through 2020, from which the sports hall of the Waldorf school Prien has received more than 55.000 euro

already. The NPOs receive the benefits (3%) in the Chiemgauer currency and they spend it again in the local business cycle. Since businesses re-spend two third**s** of their Chiemgauer (Christ, 2014: 52), the benefits refinance themselves completely assuming that the gross margin of enterprises is one third. The non-profit-organizations produce common goods like education, social and environmental care, cultural enrichment and research. These public goods are the basis for social life and also the economy. Both consumers and entrepreneurs see the Chiemgauer as a tool for a positive impact on the society (Christ, 2014: 55; Meßenzehl, 2005: 83).

Another important component of the Chiemgauer is the circulation incentive which is also discussed as theory of negative interest (Grasselli and Lipton, 2019; Kimball and Agarwal, 2019). Cash Chiemgauer are only valid for half a year but you can prolong the period for another half a year when you buy a sticker which costs 3% of the nominal value of the Chiemgauer. If it is July 1 and you have a 10-Chiemgauer-note which is only valid through June 30th , you can buy a sticker for 30 Cents and stick it onto the note. Then you can spend the Chiemgauer until December 31st.

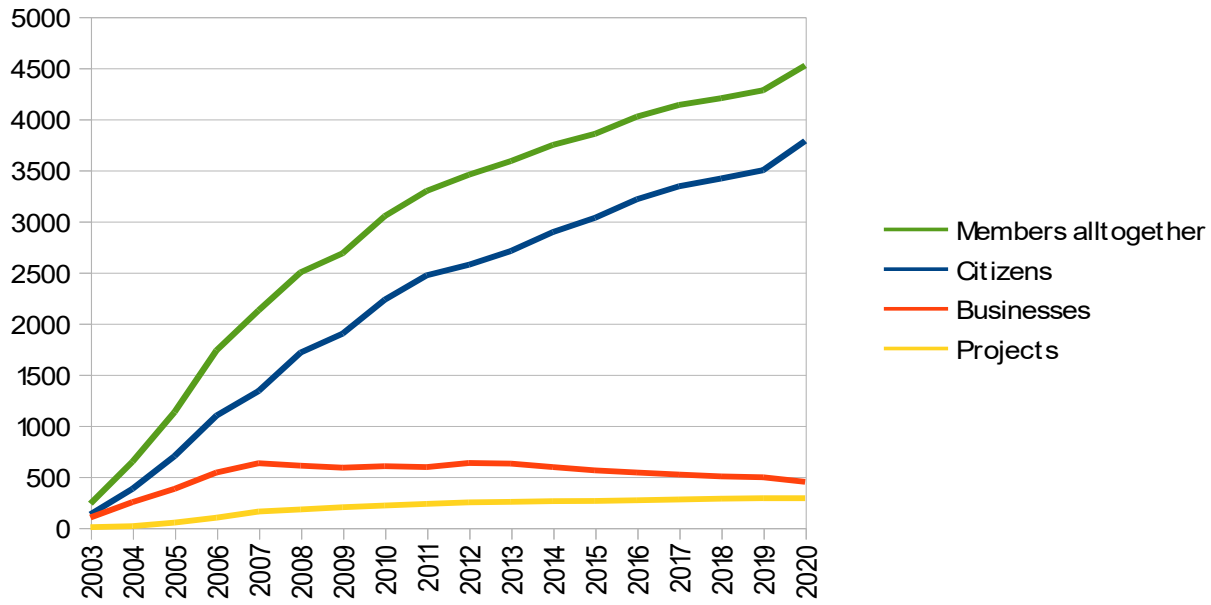
Businesses accept the Chiemgauer up to the last day. If they have a Chiemgauer account, they can deposit the Chiemgauer up to two weeks after expiry. The circulation incentive is applied on the Chiemgauer account too but only after the 90th day. The calculation of the negative interest rate works with the first-in-first-out-principle. The oldest desposits are substracted from the sum of the incoming amounts of the last 90 days. The negative interest is only calculated on the residual amount. This pragmatic approach lowers the negative interest cost for the users while reaching the goal of a steady velocity of money.

4. CHIEMGAUER DEVELOPMENT IN FIGURES

The development of the Chiemgauer is emphasized by the number of people using the local currency.

Figure 4 shows a steady upward trend in the number of members and a slight drop in businesses. The decline with businesses is part of a bigger global trend, between 2005 and 2019 the market share of owner-based non-food businesses has halved (Handelsverband Deutschland e. V., 2020).

Figure 3: Number of Members of the Chiemgauer association



Source: Authors' own calculations

After 16 years the Chiemgauer has reached a significant level of members in the region. People using Chiemgauer are not looking for the cheapest price or low quality. They want to promote the region and non-profit-organizations. They confirm that they consume with more awareness for the region and have found new shops in the regions (Meßenzehl, 2005: 79). Consumers see in regional money a tool to do something positive for the region and to help guide its development (Meßenzehl, 2005: 84).

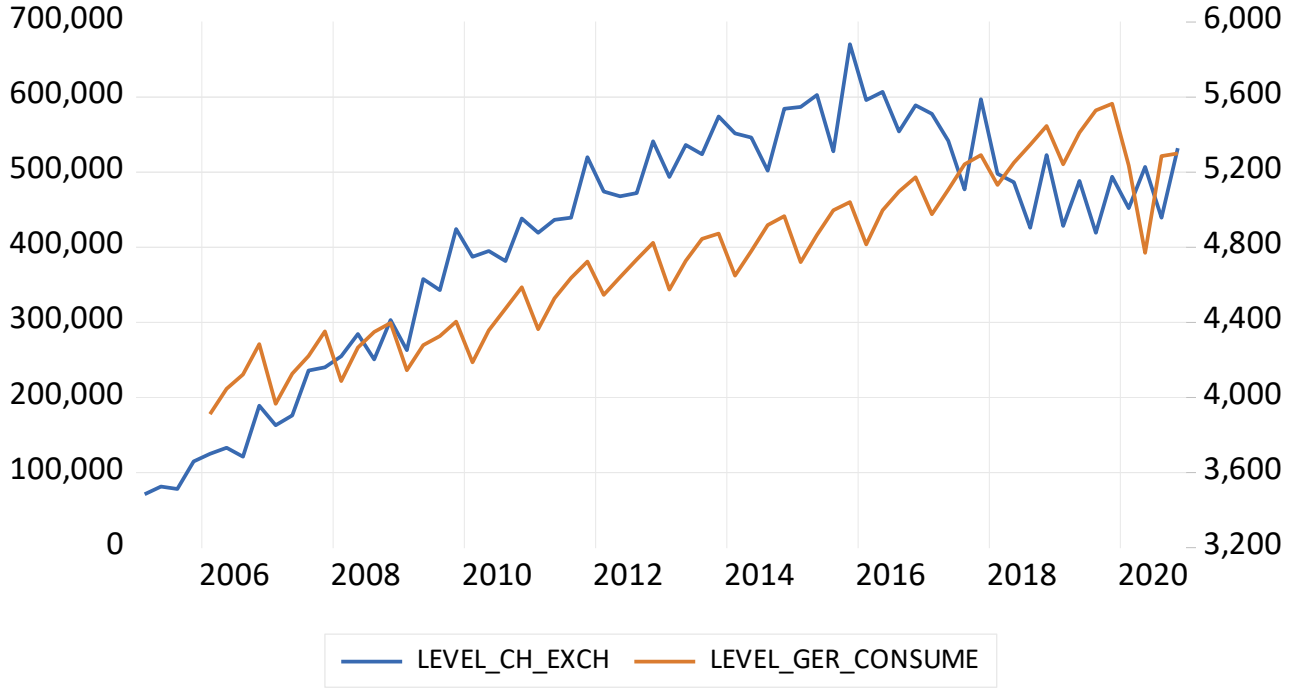
Three quarters of users find that the Chiemgauer is easy to use and see no additional effort in the Chiemgauer (Meßenzehl, 2005: 81). 70% of users feel more enjoyment when they shop and 81 per cent of users like the circulation incentive of the Chiemgauer (Meßenzehl, 2005: 75).

Women make 70% of the total exchange of Euro in Chiemgauer. This figure is not uncommon because the proportion of women in consumer spending is about 70% in Germany too (Silverstein and Sayre, 2009).

4.1 Economic data 2003 to 2020

For a reserve-backed currency it is vital to motivate people to exchange as much as possible into the complementary currency. The activity of consumers can be measured by their willingness to exchange the national currency Euro into Chiemgauer.

Figure 4: Exchange from Euro into Chiemgauer and average consumer spending in Germany



Source: Authors' own calculations

The figure above shows the quarterly amount of exchange in euro on the left side and the average quarterly consumer expenses per person in euro on the right side. We can see a high correlation between the consumer expenses and the exchange into Chiemgauer. The higher the consumer expenses are the higher the exchange from Euro into Chiemgauer. The growth rates of the quarterly exchange was quite strong for the first thirteen years of existence of the Chiemgauer. Then there was a decline in 2017 with a stagnation for three years.

In 2020 there was a break with consumer expenses caused by a lockdown to prevent further cases of Covid-19. The Chiemgauer exchange increased at the same time by six per cent. A spread can also be discovered between 2008 and 2010 when exchange increased more than in the long-term trend. It seems that the Chiemgauer is linked with the long-term development of the economy and responses counter-cyclical to economic crisis in the short run. One reason can be found in the incentive to spend the Chiemgauer again which has a strong impact on the frequency of changing hands that can be thought of as the "velocity" of money (Wicksell, 1898: 46).

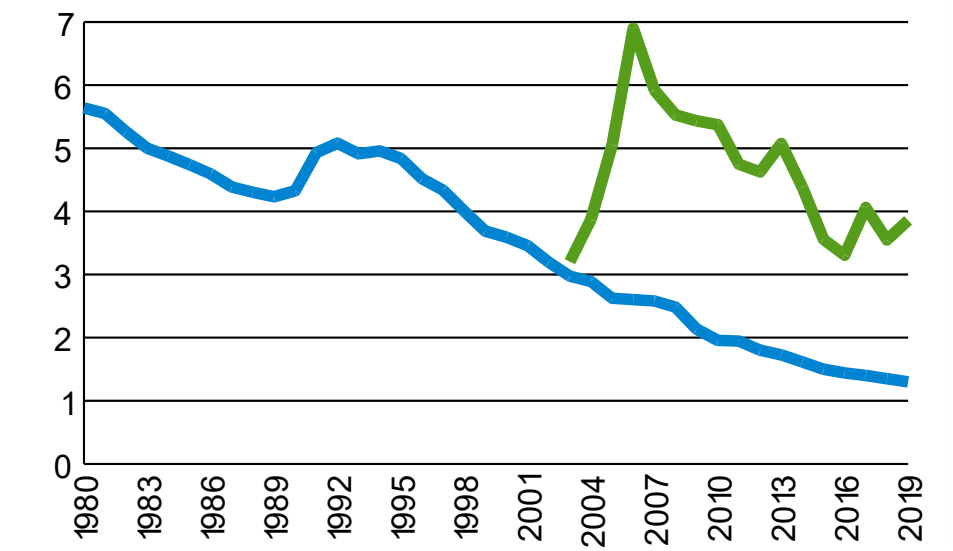
4.2 Quantity theory and velocity of money

The velocity is calculated with total sales divided by money supply. Fisher refers to it with his formula of the quantity theory: M x V = T x P (Fisher, 1922), that means that the velocity (V) times money (M) results into the transactions

(T) measured by prices (P). This is equivalent to the turnover approach (Friedman, 1987). His quantity theory is also used for the national economy with M x V = Q x P where Q is GDP. We have to distinguish V_Q from V_T and make sure that we keep V_Q or V_T with its appropriate factor.

The regional value added of the Chiemgauer is determined on the basis of the total sales, which is corrected by a value-added factor. Sales in Germany are more than two times gross domestic product (Destatis, 2020). At each value-added level, this method deducts purchased goods from turnover. The gross domestic product summarizes the value added shares. At Chiemgauer, we use the same factor to move from total sales to Chiemgauer "gross domestic product" (Q). For the amount of money we add the cash Chiemgauer and the digital Chiemgauer in circulation. These two amounts are comparable to the sum of cash Euro and Euro on current accounts due daily. With these kind of data we can give a picture of the "real economy". There is also a "financial economy" with turnover for assets and rights and we could also consider a "black economy". Keynes distinguished between the speculative and precautionary motivations for money demand, but we focus on his third motive, the transaction side (Davidson, 1990).

Figure 5: Velocity of the Chiemgauer (green) and the Euro (blue)



Source: Authors' own calculations

The figure shows the annual velocity of the euro since 1980 and the annual velocity of the Chiemgauer since 2003. Chiemgauer changed hands four times per year in 2019. While the velocity of the Euro has been steadily decreasing for years, the Chiemgauer remains at a high level. The Chiemgauer circulates more than three times faster than the euro. Given a certain quantity of goods, let's say 100 pieces for one euro each, you can achieve the goal by issuing 25 Chiemgauer that circulate four times or by issuing 75 euro that circulate only 1.33 times.

National currencies in the industrialized world have a problem of decreasing velocity over time (de la Rosa and Stodder, 2015). A sharp drop in velocity can lead to a recession and/or deflation. States and central banks try to prevent recessions by increasing the amount of money. The velocity of money, however, is not controlled by a central bank. The focus on controlling only the amount of money has many side-effects which could be prevented, if we could also control the velocity of money (Rogoff, 2017). Side-effects are strong increases of money supply for speculative purposes, the increase of demand for assets like company shares and land and also an increasing inequality in the population because the additional money is concentrated in the hands of the top one per cent of wealthy people (Colciago et al., 2018: 3). By contrast, a high and stable velocity decreases the need for additional money printing or additional government debt (Gelleri, 2008: 8).

The central bank argues that it is no problem to anticipate the decreasing velocity of money. They increase the money volume by ten per cent a year and take into account the growth rate, the decreasing velocity and the goal of two per cent inflation. A drop of velocity of four per cent, a growth rate of three per cent and an inflation rate of two per cent needs an increase of nine per cent of the money volume. The interest rate is reduced to a level that the goal

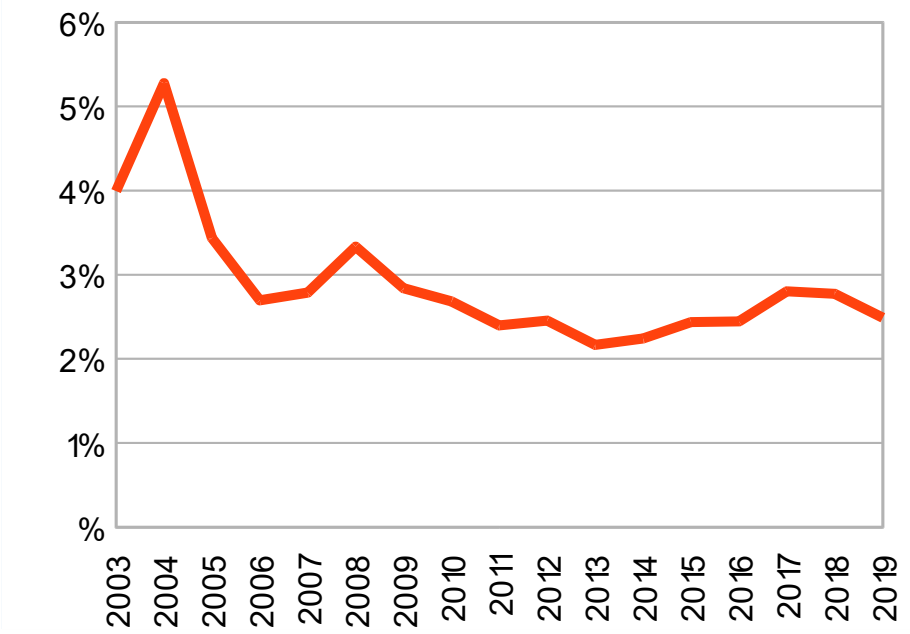
of two per cent inflation is achieved in the end. One problem is that the central bank doesn't know in advance the growth rate and the decline in velocity. Therefore modelling of the future with anticipating forecasting variables are very important (Fritsche, 1999). Great problems for the economy rise when forecasts don't work like in the financial crises or with the Covid-pandemic. But even before there are structural breaks in velocity of the euro which lead to recessions (Beyer, 2009). The idea only to control the money supply (Friedman, 1987: 31) fails because of these uncertainties (Wray, 2018: 18).

The Chiemgauer uses a circulation incentive to stabilize the velocity of money. This reduces the uncertainty. Recessions could be less deep if their causes were merely monetary. But even in the case of external shocks caused by a pandemic in 2020, the mechanism of carrying costs on money can help the economic recovery to take place much faster, because people are immediately in the starting blocks to spend their aging money (Keynes, 2013: 357). It has countercyclical behaviour in the macroeconomic environment. Businesses tend to use the Chiemgauer more within the network in times of recessions and crisis. The circulation incentive keeps the dynamics of the Chiemgauer system running, without the members being much bothered by the rule themselves (Meßenzehl, 2005: 75; Ziegler, 2009: 52).

4.3 Costs and money-multiplier

The speed of circulation also plays a major role when it comes to the costs for companies. The higher the velocity within the network, the lower the cost.

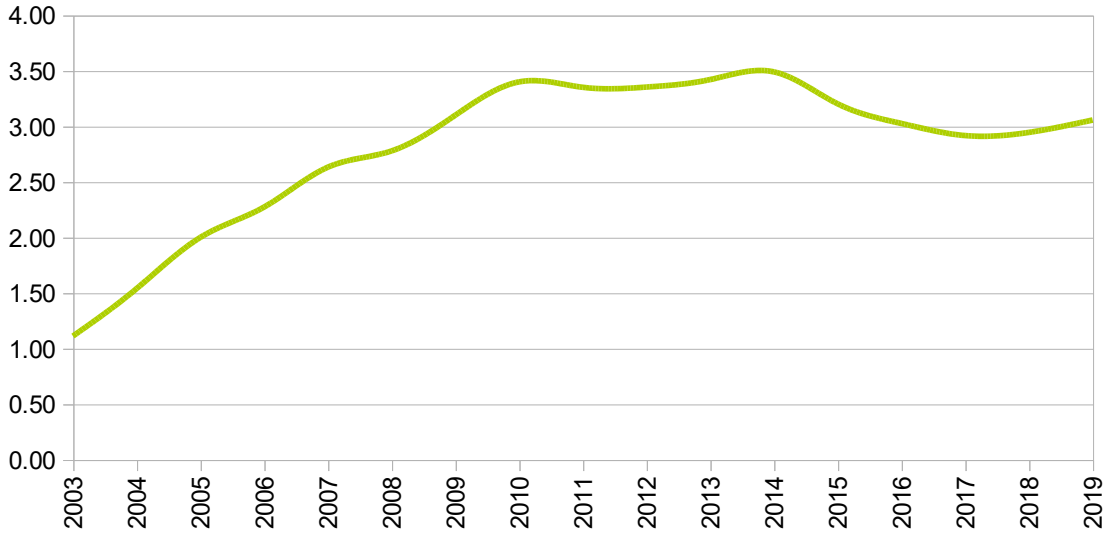
Figure 6: Average costs as percentage from sales



Source: Authors' own calculations

The average cost was at 4% of sales in the beginning. Over time, the percentage costs fell to 2.5%. The level of costs depends mainly on the transfer of regional money in the regional economic cycle. The larger the network, the easier it is to use the currency. Businesses have also learned over time to handle the Chiemgauer more easily (learning-curve effects) and have found more possibilities to spend (increasing returns to scale). Both result in an increasing money-multiplier which is calculated as turnover in Chiemgauer divided by the exchange from euro into Chiemgauer:

Figure 7: Money-multiplier of Chiemgauer (Chiemgauer-turnover / Chiemgauer-exchange)



Source: Authors' own calculations

5. ECONOMETRIC ANALYSIS OF CHIEMGAUER CURRENCY

So far, we have looked at developments in isolation. In the next step, we analyze the Chiemgauer in its relation to macroeconomic variables. Following on from the analysis of the complementary currency WIR (Stodder and Lietaer, 2016), we assume a monetary production function and examine to what extent the macroeconomic influence has on the events of the Chiemgauer and whether the cycles have any effects in connection with it (Stodder, 2009).

A simple comparison between the velocity of the euro and the Chiemgauer already provided the first indications that there are significant differences. With an econometric analysis, the connections between the Chiemgauer network and its surroundings can be better checked.

5.1 Concept of Vector Error Correction Models (VECM)

With the help of a regression analysis, we try to explore the relationships between two or more time series. This attempts to bridge the gap between theory and a model to the real world (Auer and Rottmann, 2020: 416). Methodologically, Vector Error Correction Models (VECM) have proven their worth in econometrics (Engle and Granger, 1987; Sargan, 1958). They allow not only a long-term but also a short-term analysis of the correlations. In the long-term relationship, the variables are used in their original form ("level data"). For the short-term relationships, the first derivatives of the variables are used ("first Difference").

The basic form of a general vector error correction model is as follows:

$$\Delta Y_t = \varphi z_{t-1} + \sum_{i=1}^{n} \beta_i \, \Delta y_{t-i} + \sum_{i=1}^{n} \delta_i \, \Delta x_{t-i} + \propto_0 + \partial_1 t + u_t$$

The first term for each period (t) consists of a cointegration regression equation z, which refers to the previous period, the discharges of y delayed by n months, the discharges of x delayed by n months and, depending on the model, a drift (∝-0.) and trend component (t). U represents a residual interference term. The cointegration regression z represents the linear combination of X and Y. The model only works when φ on the cointegration equation (CE) is negative. CE is defined as:

$$z_{t-1} = y_{t-i} - \beta_0 - \beta_1 x_{t-1} - \partial_2 t$$

If the model is completely in equilibrium in the long term, z assumes a value of zero. Assuming that is true, the long-term relationship can then be expressed as follows:

$$y_{t-i} = \beta_1 x_{t-1} + \beta_0 + \partial_2 t$$

5.2 Relation between Chiemgauer network and economic environment

Before developing an econometric model, it makes sense to illustrate the intuitive contexts:

Figure 8: Relations between Chiemgauer-system and GDP and unemployment

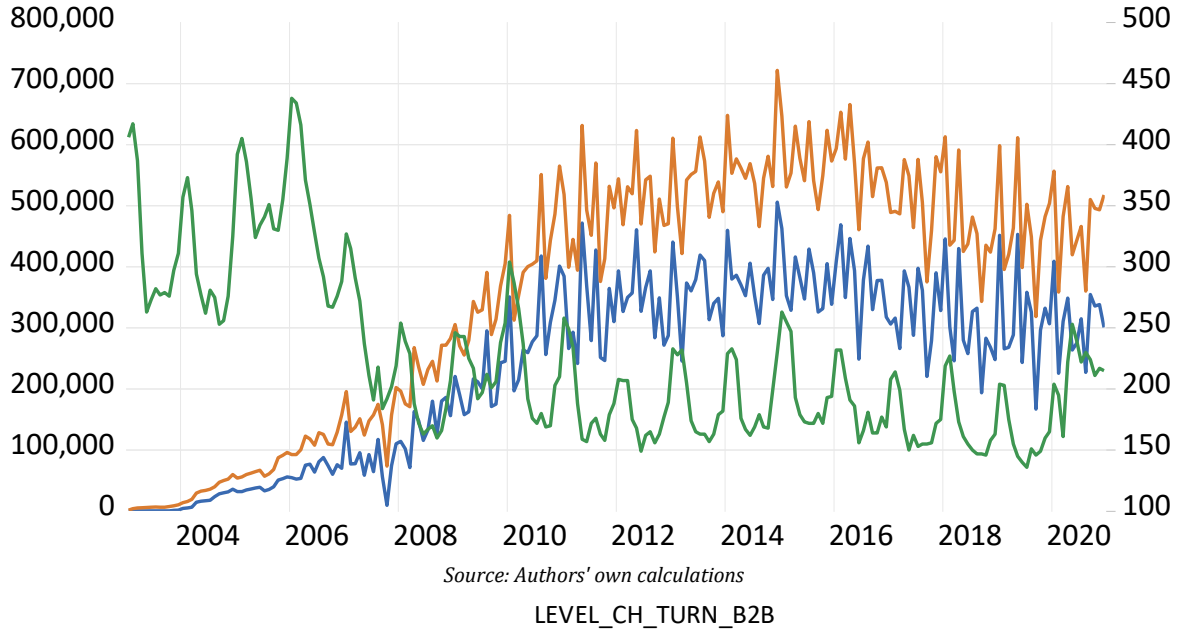
Source: Authors' own calculations

The chain of action distinguishes between macroeconomic and regional economic variables (blue) on the one hand and variables belonging to the Chiemgauer network (green). Suspected correlations with the national or regional context are marked with orange-yellow arrows. In the case of reserve-backed complementary currencies, it is likely that the exchange in a regional currency will increase with increasing income and the gross domestic product (GDP). We assume with figure 7 that exchange increases with disposable income. If there is an exchange of euros in Chiemgauer, the Chiemgauer money supply increases. If the Chiemgauer remain in circulation, the money supply continues to increase and Chiemgauer turnover is generated. There are two types of Chiemgauer turnover, first, the expenses of consumers, and second, transactions between businesses. Turnover transform to incomes in the value chain and in turn, lead to consumer spending, much of it in Chiemgauer. The link to the Chiemgauer network has a self-reinforcing effect, which has an impact on the Chiemgauer money supply, the Chiemgauer circulation and other Chiemgauer incomes. If income effects could be demonstrated, the next question would be whether they have an impact on employment into the local unemployment statistics. In Wörgl this effect was immediate because the municipality had directly hired the unemployed and paid them out in the local currency. Indirect effects were described similar to the Chiemgauer circle with consumer spending and business to business turnover. The effect for the first year on the unemployment level was guessed with 11 to 16% (Ottacher, 2007: 61).

6. EFFECT OF THE CHIEMGAUER ON LOCAL UNEMPLOYMENT

A Vector Error Correction Model of the Chiemgauer with regional unemployment shows the problem that the impact is obvious but with a weak statistical significance. The focus on the local level increases the impact. Because the Chiemgauer was started at Prien at lake Chiemsee the turnover is applied on the unemployment number of Prien. First we have a look at the original data (or "level data") in a graphical form:

Figure 9: Level of Chiemgaure turnover (orange), B2B turnover (blue) and unemployment Prien at lake Chiemsee (green)



Source: Authors' own calculations

The absolute unemployment figures for Prien at lake Chiemsee (in short "UE_RO_PRIEN") on the right-hand side are shown starting with 406 unemployed people in January 2003. The Chiemgauer sales ("CH_TURN") are visible on the left axis. In addition to the total sales of the Chiemgauer, the sales between the Chiemgauer companies ("CH_TURN_B2B") are presented. Model development has shown that the turnover of companies adjusted for the Chiemgauer exchange is more closely related to unemployment than to total turnover. This can be explained by the fact that the Chiemgauer exchange only causes a one-time turn of the euro in the region. This is compared to gift vouchers that are immediately exchanged back. The special feature of the regional currency, however, is that there is a follow-up turnover between companies and this share is more relevant for increasing employment. This discussion is further deepened and begins with the presentation of the more significant model between the Chiemgauer business to business (B2B) turnover and the unemployment rate in Prien.

Chiemgauer sales appear to be an inverse pattern compared to the unemployment rate. The first phase of rising sales is linked to falling unemployment in Prien. From 2010, the movements will be transferred to a parallel and almost stationary course. The very low level of unemployment is combined with a slight decline in Chiemgauer sales between 2017 and 2019. In 2020, there is a peculiarity that both the number of unemployed and turnover will increase. The graphic connections show a diverse interplay in different phases, so it is interesting to see what an advanced econometric model looks like.

7. STEPS TO PREPARE THE REGRESSION MODEL

To find out what model fits to the both time series, there are different tests to find out the best parameters (Engle and Granger, 1987). A test of the optimal lag lengths shows a clear signal at 15 lags. A Johansen test shows a quadratic model as the optimum according to the Akaike information criterion (Akaike, 1974), but in practice simple or linear models should be preferred due to the ambiguous interpretation (Johansen, 1991: 1561). A model with a linear deterministic trend and intercept has the second best result in the Akaike information criterion. The cointegration equation in this model contains both an intercept and a trend component and the error correction equation contains only an intercept component. Therefore, this should be taken into account in the unit root test for the logarithmic original form (Maddala and Kim, 2010). The null hypothesis of the Johansen-test that there is no or only one cointegration is clearly rejected after the trace and max self-test (5% level). The test procedures indicate two cointegrating equations, on the one hand with the unemployment rate in Prien and on the other hand with the Chiemgauer company turnover as a dependent variable.

Unit root tests are necessary to avoid spurious regressions (Granger and Newbold, 1974). There are different test methods for unit root testing (Im et al., 2003; Kwiatkowski et al., 1992). A cointegration is possible when the time series have unit roots for the original data and when they are stationary for the first differences (Wooldridge, 2013: 632). A unit root testing procedure based on three test methods approves that the time series can be used for further

modelling (Im et al., 2003; Kwiatkowski et al., 1992; Maddala and Wu, 1999). Next, the direction of the context is checked with the help of a Granger causality test:

Pairwise Granger Causality Tests; Sample: 2003M01 2020M12 with 15 lags

Null Hypothesis:	Obs	F-Statistic	Prob.
LN_CH_TURN_B2B does not Granger Cause LN_UE_RO_PRIEN	201	2.42916	0.0031
LN_UE_RO_PRIEN does not Granger Cause LN_CH_TURN_B2B		1.92197	0.0240

The test shows a unique two-way determination of the variables with significance-levels below 5% and for the effect on unemployment even below 1%. This fits with the Johansen test, which indicates the presence of two cointegration equations.

7.1 Result of the VECM between Chiemgauer and local unemployment

Based on the consistency of the tests, a vector error correction model with a lag length of 15 is created based on a linear deterministic model with time trend and intercept:

Cointegrating Equation:

LN_UE_RO_PRIEN(-1)	Equals (=)
Constant	8.672328
LN_CH_TURN_B2B(-1)	-0.261996
	[-6.81365]***
TREND	-0.001212
	[-2.38832]**

	D(LN_UE_RO_PRIEN)	D(LN_CH_TURN_B2B)
Coefficients on Error from	-0.157067	-0.857404
Cointegrating Equation:	[-3.24460]***	[-4.57243]***

Coefficients on Lags of Significant 1st Differences:

D(LN_UE_RO_PRIEN(-4))		0.742386
		[2.59375]**
D(LN_UE_RO_PRIEN(-5))		1.081155
		[3.69292]***
D(LN_UE_RO_PRIEN(-6))		0.764383
		[2.54306]**
D(LN_UE_RO_PRIEN(-7))		0.619427
		[2.24660]**
D(LN_UE_RO_PRIEN(-9))	-0.145298	
	[-2.01746]**	
D(LN_UE_RO_PRIEN(-11))	0.158176	
	[2.23907]**	
D(LN_UE_RO_PRIEN(-12))	0.572292	0.707004

	[7.98170]***	[2.54558]**
D(LN_UE_RO_PRIEN(-14))	0.145299	1.051743
	[1.74548]*	[3.26173]***
D(LN_CH_TURN_B2B(-1))		-0.48154
		[-6.40683]***
D(LN_CH_TURN_B2B(-2))		-0.556822
		[-6.96101]***
D(LN_CH_TURN_B2B(-3))		-0.187912
		[-2.17383]**
D(LN_CH_TURN_B2B(-4))	-0.050797	-0.235483
	[-2.40225]**	[-2.87493]***
D(LN_CH_TURN_B2B(-8))	-0.036776	
	[-1.76613]*	
D(LN_CH_TURN_B2B(-10))		-0.153255
		[-1.99911]**
CONSTANT		0.064817
		[2.94926]***
R-squared	0.627889	0.535178
Adj. R-squared	0.559225	0.449407
F-statistic	9.144445	6.239623
Log likelihood	279.6497	8.813373
Akaike AIC	-2.476497	0.231866
Schwarz SC	-1.948766	0.759597

To determine the critical values for the t-statistics(shown in square brackets), the first thing to do is to calculate the degrees of freedom resulting from the difference between the observations and the coefficients used: Degrees of freedom = 200 - 67 = 133.

To interpret the above regression, the first cointegrating equation can be considered the long-term relationship between B2B turnover and unemployment in Prien. The negative sign on the coefficient for Turnover shows that its growth tends to reduce regional Unemployment, and the negative sign for the coefficient on the trend indicates that this Unemployment has also tended to fall, independently of Turnover.

Looking at the coefficients on the error term from the cointegrating equation, we see that they are both negative. That is to say, when one of these two variables gets so large as to increase the error term in the long-term relationship between unemployment and Chiemgauer turnover, then the size of that variable should be reduced. This is as we would expect from a stable "error correction" relationship. Let us now examine the significance of these coefficients.

Hamilton (Hamilton, 1994) notes that the standard critical values for t-values are +/- 1.96 at a 5% significance level and a value of +/- 1.645 at 10%. But he estimates the specific critical values for the coefficient of this error correction term are -3.42 (5% level) and -3.13 (10% level). The cointegration equation for the unemployment rate in Prien as a dependent variable reaches a 10% significance level with a t-value of -3.24. For Chiemgauer company turnover, the t-value exceeds 5% significance at -4.57.

Looking at the coefficients on the first difference terms above, we have only included those that are statistically significant – that is to say, by the standard 'p-value,' their chances of having occurred strictly by random variation (and not showing a long-term structural relationship) is less than 10% (indicated by one star,*), 5% (two stars, **), or 1% (three stars, ***). That is to say, when this p-value is low (and the T-statistic high), we can reject the null or maintained hypothesis that there is no real underlying relationship with the p-value as the small probability that we are wrong to do so.

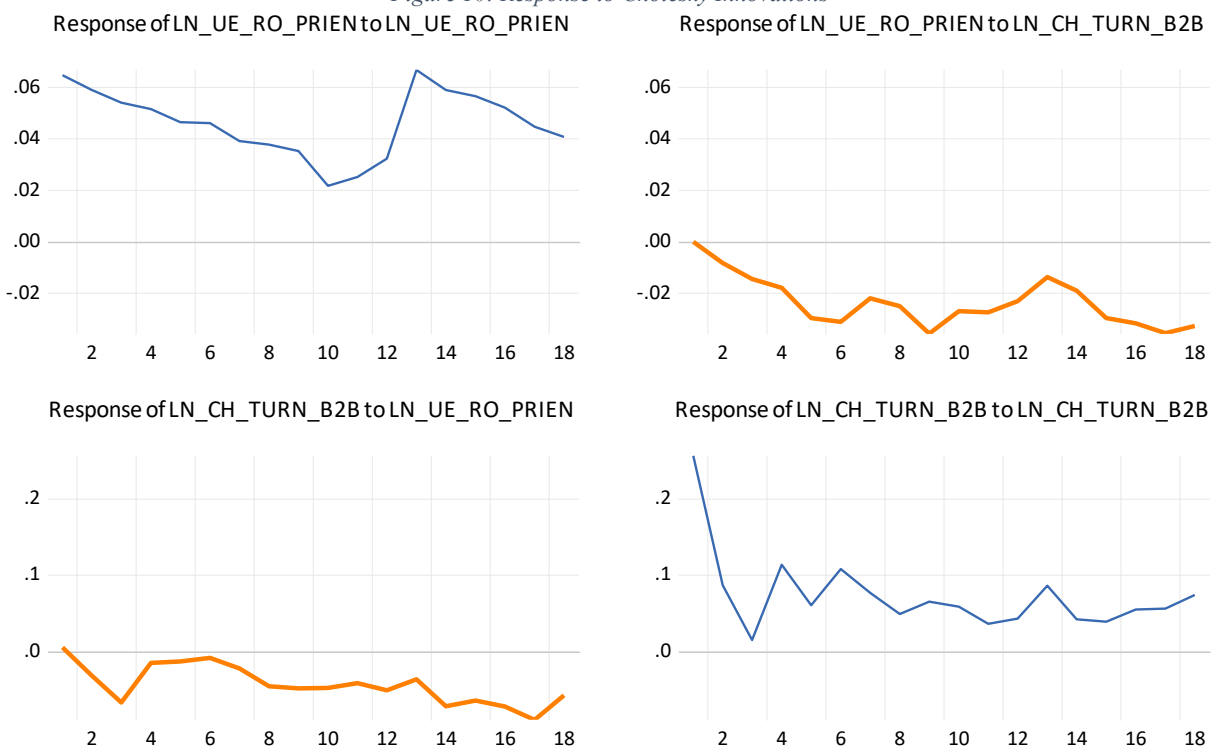
Now we can examine these coefficients on the first differenced terms at various lags, from 1 to 15 months before the current observation. Here we see that, in contrast to the stable long-term or 'secular' relationship between turnover and unemployment, we have a counter-cyclical or stabilizing relationship between short-term disturbances. In the 2nd column of the above table we see that an increase in unemployment 4, 5, 6, 7, 12, or 14 months ago tends to significantly boost B2B Turnover for the current month. This is counter-cyclical because such B2B activity is increasing when the regional economy itself is declining, as shown by higher unemployment.

In the 1st column we see that a rise in B2B turnover 4 or 7 months ago has the effect of reducing Unemployment in the current month, and significantly so. An increase in B2B turnover in Chiemgauer from rising unemployment would be important in itself, even if it did not have any effect on counteracting that unemployment. That is because it would allow businesses and consumers an alternative means of meeting their needs, even in a downturn when supplies of ordinary currency are tight. But of course if the increased B2B turnover in Chiemgauer can actually reduce unemployment, that is better still and that is what these results indicate.

7.2 Interpreting reaction graphs and further model checks

The reaction graphs, in combination with the vector error correction model, help to interpret the results:

Figure 10: Response to Cholesky Innovations



Source: Authors' own calculations

Unsurprisingly, the effect of a variable's past on the present declines over time. Past unemployment in Prien has a positive effect on the current unemployment rate in recurring rhythms. In terms of Chiemgauer B2B turnover, the first month has the strongest impact on current sales, followed by uniform positive correlations. At the bottom left, an increase in the number of unemployed in Prien is followed by a decrease in Chiemgauer company turnover. In the error correction equation, however, countercyclical behavior occurs mainly in the short and medium term. In particular, increases in unemployment between four and seven months are significantly negatively correlated with

sales. If the number of unemployed rise, a few months later, Chiemgauer B2B turnover will also rise, which, through its negative correlation with the number of unemployed (graphic at the top right), helps to stabilize the situation.

The presentation of the long-term cointegration equation helps to further interpret the correlations with the unemployment rate:

LN_UE_RO_PRIEN = -0.262 x LN_CH_TURN_B2B(-1) - 0.001212x @TREND(03M01) + 8.672328

The number of unemployed in the market village of Prien is influenced by the Chiemgauer company turnover in such a way that an increase in turnover leads to a falling number of unemployed. The relationship is significant over the observation period. The long-term impulse effect is 26.2%. This means that an increase in sales by one percentage point will lead to a 0.26 percent reduction in the number of unemployed. The trend component enhances the effect, but the drift component (8.67) damps the effect and show that a certain level of turnover is needed for these effects to occur. In the first year of issuance the exchange was 68.000 Chiemgauer and only another 7.000 Chiemgauer were spent again by businesses. Therefore the founding year unlikely played a role. As sales however reached the six-digit range they are likely to have had an impact in the market village as early as 2004.

The Granger test for the original data has shown bidirectional Granger causality before. When we repeat the test for the differentiated error correction regression, we also see a two-way causality with significance levels of 5.93 per cent for the unemployment as dependent variable and 0.18 per cent for the Chiemgauer B2B turnover as dependent variable. For the unemployment rate in Prien, the significance level is as high as for the cointegration equation at a 10% level. The precedent set by the number of unemployed is even clearer for Chiemgauer business turnover.

To be sure that the model is solid another three tests were done which will be described only in short: Regressions shouldn't be autocorrelated (Granger and Newbold, 1974: 117) and the variance of the error term should be identical (Auer and Rottmann, 2020: 447). The model should be also structurally constant (Barnard, 1959: 241). For the autocorrelation we used a test method developed by Breusch and Godfrey (Auer and Rottmann, 2020: 599). Another test for homoscedasticity was done with methods after Breusch, Pagan and Godfrey and after White (Wooldridge, 2013: 279). All tests approved that the model is robust and structurally constant.

7.3 Countercyclical effects of the Chiemgauer

The model shows that the Chiemgauer-turnover between businesses had a significant impact on the local unemployment number of Prien. An absolute comparison shows that the Chiemgauer contributed to decrease in the number of unemployed by 3% between 2003 and 2020. Very similar effects could be replicated for the city of Traunstein with a decrease of 3.2% over the last 16 years. These effects were without any subsidy from the local authority. The effect could be much higher when fiscal policy on the local level would be combined with the multiplier effect of the Chiemgauer.

An interesting finding was that the share of turnover between companies is more countercyclical than the turnover generated by consumers. This B2B component appears to be very similar to turnover in mutual credit systems. Therefore it is very important that regional currencies backed with national currency have a high monetary multiplier in terms of exchange. This result may be compared to the strong countercyclical effects found for turnover of the Swiss WIR ((Stodder, 2009; Stodder and Lietaer, 2016), since its turnover is also predominantly B2B.

8. CONCLUSION AND FURTHER QUESTIONS

The velocity of the Chiemgauer has become stable over the last ten years. Increasing the money supply, and yet still having a stable money multiplier in the economy, is something a central banker could only dream of. Normally you have to balance the money supply, because the velocity decreases every year and by stabilizing the velocity you can concentrate on the control of the money supply. This state is based on a hard rule: a negative interest rate on both the digital and cash Chiemgauer.

The Chiemgauer example shows the countercyclical effects in times of crisis. A close historic example can be seen in Wörgl. With the investment in public goods and the acceptance of local taxes, the adoption of local currencies speeded up in the Great Depression in the 1930s (Fisher et al., 1933).

To address the challenges after the 2020 recession national or regional governments can support complementary currencies through fiscal or monetary policy. The Wörgl currency was supported by the government of that Austrian city in 1932 to encourage regional development (Broer, 2013). Today some complementary currencies are funded by local authorites. In 2020 the city of Charlesroi, Belgium, issued four million euro to citizens to strengthen local business cycles (Gelleri, 2021). In the city of Mumbuca in Brazil monthly social benefits are even paid in the regional currency of Palmas in cooperation with an officially registered payment service provider (Faria et al., 2020). In Barcelona, Spain, a part of social benefits were paid with the local currency REC. The design, operation and evaluation was paid by the European Union and the city of Barcelona (Martín Belmonte, 2019). All currencies belong to the type of reserve-backed currencies (Gelleri, 2020b). In most cases the reserve in national currency was paid in advance by government agencies but there are also cases where they only guaranteed for the redemption. The latter are indeterminate liabilities which could be seen as fiscal instruments that broaden the fiscal financial scope (Menéndez and Goldoni, 2019).

The econometric analysis of the Chiemgauer underlines the enormous importance of the local money multiplier of public expenditure. If it is possible to raise local circulation to a significant level, the fiscal impulse will have an even stronger effect.

The Chiemgauer experience may also hold lessons for the rise of Central Bank Digital Currencies, or CBDCs, much-studied by leading central banks (Mancini-Griffoli et al., 2018). A handful of central banks are running or have completed pilot-projects (Auer et al., 2020: 7). Our initial judgement is that CBDCs in the conventional sense won't show the counter-cyclical effects of the Chiemgauer or WIR.

The primary reason is that a CBDC isn't meant to form a "secondary" or complementary currency like the Chiemgauer or WIR in the "real economy". This "second best" character may be crucial to their counter-cyclical functioning (Stodder, Lietaer, 2016). A CBDC as normally understood is rather meant to substitute for ordinary national currency, and indeed, to be preferable for many purposes like the function as store of value (Bofinger and Haas, 2020: 42).

On the other side a CBDC issued by central banks could also be re-imagined as counter-cyclical payment systems on a regional or national level (Gelleri, 2019; Hockett, 2020). If the central bank would be working together with government entities and the civil society, complementary currencies could be tailored for societal goals and at the same time they would remain integrated in the monetary system of the state. The fact complementary currencies are not only tolerated but officially supported was reflected in a law in France on the solidarity sector, which was officially enshrined in law in 2014 (Blanc and Fare, 2019; OECD/European Union, 2017). Anyone who thinks of the future of money can see in these developments first signs of a redesign of the monetary system, which contains more resilient, pluralistic and democratic components than it does today.

The rule of law in dealing with complementary currencies depends very much on societies' assessment of the concrete benefits they can bring. But they can only prove successful if they are allowed to scale up in settings of regional cooperation. The more possible it is to examine the mechanisms of action, the greater the willingness to integrate the approach into the political economy. On the way we should use more institutional experiments to learn what complementary currency designs are effective in solving societal challenges like climate change, unemployment and inequality (Feichtner, 2020).

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