Norwegian School of Economics
Bergen, Spring, 2018

Local currencies : The context of their emergence

An explanatory model on the number of local currencies launched in France from 2007 to 2017

Manon Simon

Supervisor: Bjørn L. Basberg (NHH) & Frédéric Vrins (UCL)

Master thesis, Double Degree, Energy, natural resources and the environment

NORWEGIAN SCHOOL OF ECONOMICS

The writing of a thesis is a long and collective process. I would thus, hereby, take the time to thank the people that have helped and guided me along the way.

I would especially like to express my gratitude to my two supervisors, Professor Bjørn L. Basberg from Norges Handelshøyskole and Professor Frédéric Vrins from Louvain School of Management as well as Professor Karine Cerrada from Louvain School of Management for taking the time to provide me with their guidance and their enlightened clarifications which greatly helped my understanding of the task and significantly increased the quality of my thesis.

I would also like to give a warm thanks to my grandfather and my parents for their feedback, their precious advice and their unwavering support as well as for their practical and logistical help.

Finally, I would like to thank my friends for their support and for sharing this experience with me. I would especially like to give acknowledgment to Nathan and Emeline who have never been shy of sharing their wisdom and who have always been immensely supportive even in times of doubt.

Abstract

The aim of this thesis was to identify the contextual factors that influence the creation of local currencies. To pinpoint these factors, two multiple linear regression models were developed in which the choice of the dependent variables was based on the literature review as well as on current and historical examples of established local currencies. The first model aimed at explaining the factors influencing the number of local currencies established in a region whilst the second model aimed at depicting the factors influencing the number of local currencies created annually at a national level. Data from France from 2007 until 2017 was used to test the hypotheses in both of the models. It was found that at a regional level, population size and organic agriculture influenced positively the creation of local currencies whilst higher income and an increased electricity consumption had a negative influence. Strong country debt, inflation and poverty rate were the three significant factors that were identified to increase the number of local currencies created annually at a national level.

Preface

My attention was drawn to local currencies as several have been launched in my close environment and they are increasingly being mentioned in the news stories in the media.

As the interest for local currencies is growing, most associations that have launched these advertised on the benefits of using local currencies but not the reasons that had pushed them to launch them in the first place. Their main arguments were often linked to living in a more environmentally-friendly way without giving a more comprehensive justification than supporting the local economy and supporting short local supply chains.

In parallel, I heard about local currencies that existed in the 1970s in Italy. These had been usually launched by local banks due to a lack of coins minted by the central bank. The aim of these very small bills were to allow shop holders to give change back to their customers instead of small goods such as candy or lighters which they had been resorting to due to a shortage of small change.

By doing some research on these alternative currencies, I realized that there could also be other reasons to launch them such as improving a social context or defending a specific identity in opposition to a national authority.

The combination of these personal discoveries led me to wonder if there were similarities between the reasons that led these Italian local currencies long since extinguished to be created and my impression of a current outburst of local moneys in my surroundings. This reasoning led me to orient the aim of my master thesis towards exploring the different contextual factors that see an increase in the number of local currencies that could be related both to historical circumstances, such as the ones in Italy in the late 20th century as well as more recent ones.

Bergen, May 2018

Table of Contents

1. Introduction

The development of local currencies in France, as well as in other countries, in the past decade has seen an unprecedented growth. In the span of just 10 years, the phenomenon went from anonymity to around 60 emitted and functioning local currencies and about the same number of projects in earlier stages of development (Le réseau des MLCC, n.d., b). Even Paris is in the process of emitting its own complementary currency (Charrel, 2018). Local monetary systems are seen by many as a solution to a number of issues humanity currently faces: poverty, climate change, social isolation and economic crises. More importantly, they have strong ties with the ethical challenges we, humans, are confronted with today. (Larue, 2017b)

Throughout history, there have been numerous occasions during which local currencies have reemerged in various countries and for various reasons. Existing papers and books on alternative forms of money often focus on community currencies but not on local currencies in general. They tend to study more the context or users of a specific local currency or limit themselves to the explanation of a single contextual factor. These papers usually focus on qualitative and descriptive aspects rather than approach the problem from an empirical point of view. Also, very few papers look deeper into the link between the development of local currency projects and environmental awareness even though many complementary monies that are part of the current trend, claim that promoting a more sustainable lifestyle is one of their main objectives.

After preliminary definitions, a description of the local currency phenomenon and monetary theory, the purpose of this thesis will be to identify which are the contextual factors that influence the increase in this type of alternative currency projects based on historical and current examples as well as on the literature. A special focus will also be given to environmental awareness which is often absent when discussing local currencies in the academia.

These factors will then be translated into measurable indicators which can be used to build statistical tests to verify the influence of the context on the number of local currencies. A first model will be constructed in order to evaluate those factors through a regional comparison. A second similar model will also help to draw those conclusions but looking at it from a yearly perspective at the national level. The aim is to develop a model which could be used more

systematically in order to identify the underlying context to the growth of the number of local currencies.

The observation ground for the data collection necessary to run the two models will lie in France from 2007 until 2017.

2. Research question and definitions

Many cities and towns have recently decided to implement their very own local currency to encourage their inhabitants to support local producers and merchants. However, the printing of money limited to a certain geographical sector is not new. The external reasons that push local authorities, associations and citizens to use these alternative sources of cash are not well documented in the literature.

2.1 Research question

The purpose of this thesis is to study which contextual factors lead to an increase in the creation of local currencies. These factors will be determined based on the literature as well as on examples of existing local currencies. They will then be tested through a multiple linear regression model. The aim of the model is to identify the factors that influence the number of local currencies created and represent these factors by different indicators. Two different analysis levels will be used for this study: a regional comparison and a yearly comparison at a national level. The data examined in this thesis will be limited to France, excluding overseas territories, and spans over a 10-year period from 2007 until 2017.

2.2 Definitions

In this section, a few definitions and clarifications will be given as there is no common consensus on the use of the different terms throughout the academia (Larue, 2017a). There are several ways to define alternative currencies. Some have identified several generations of these currencies and define them based on the time at which they were created (Blanc, 2011). Others use the role played by the currencies to define them (Larue, 2017a). In this thesis, the role played by the different currencies will be used to define them. This will allow to take all local currencies, as defined hereafter, into account regardless of the time at which they were launched.

2.2.1 Money

According to the Merriam-Webster dictionary (2018), money is "something generally accepted as a medium of exchange, a measure of value or a means of payment: such as

- Officially coined or stamped metal currency
- Money of account
- Paper money"

Money, in a more abstract form, is also defined as "a transferable acknowledgement of debt, a promise to pay, arbitrarily created and usually with an indeterminate maturity and exchange value" (Riboud, 1980).

To these definitions, several points need to be added. The first one is the various forms money can take. These need to be defined in order to measure the money supply of a given country. These different categories are called money aggregates. First of all, it is possible to have a narrow view on what can be considered as money and only look at physical money and money that can be easily and quickly converted into cash, also called M1 or narrow money. Short-term deposits and investments, in addition to M1, make up M2. Finally, the previous category alongside longer-term deposits and investments are considered as M3. Other, more complex, deposits can also be taken into account to add up to M4 (Financial times, a). The higher the number of the category describing the asset, the less liquid the money becomes (Burda & Wyplosz, 2009).

Money is more commonly defined by the functions it occupies in the economic, financial and social spheres. This topic will be developed more broadly in a subsequent chapter.

2.2.2 Currency

The main difference between money and currency is that currency circulates, while, like stated before, money can also be a value that is not in circulation. However, the two definitions are very close and can even overlap. Currency is the money issued by a central government which is the commonly accepted form of money for transactions. The aim of currency is to facilitate the buying and selling of goods and services (Lietaer, 2001, p. 335). Usually, there is one currency per country or per super-state structures, when considering the Euro in the European

Union, around the world. It is possible to trade one currency for another on exchange markets with usually variable exchange rates.

2.2.3 Alternative currency

Alternative currency, that can also be found under the name of complementary currency, is any mean of payment that is not a currency emitted and backed by a government. They are based on trust between those that create it and those that use it and are often emitted by companies or brands, often in order to keep their currency recirculating in the same eco-system. (Kemp-Robertson, 2013).

An alternative currency can take numerous forms. A few example of these alternative currencies are coupons in retail, miles given by airline companies, loyalty cards and points.

For some, the rise of alternative currencies is a signal that market-based capitalism is coming to a close and these alternative currencies will help fight off the problems linked to our current economic system. These payment methods, also known as weak currencies, tend to remove incentives to invest passively, speculate or hold on to money for long periods of time. (Cohen, 2016).

2.2.4 Community currency

Community currencies differ from alternative currencies because “they are designed and implemented mostly by civil society, mostly locally and grassroots, and mostly in a democratic way, emphasizing the citizen’s appropriation and redefinition of money in a participative process” (Blanc, 2011). That is what separated them from corporate-created currencies for economic purposes and from national currencies which are emitted by state authorities (Blanc, 2011).

Community currencies are not limited geographically. The aim is to bring a community together no matter where the members are situated.

Common examples of this type of currency are Local Exchange and Trade Systems (LETS) and time banks. The associations to which these systems are linked reference what members

have to offer and what they would like to obtain in exchange for their offer. When trading goods and services, many offers have no counter-party and thus transactions cannot be fulfilled. LETS and time banks help solve this problem by centralizing these offers, giving a certain value to each good or service presented on the platform. These currencies can either have a physical form or only adopt a virtual form and their value is provided to them through the goods and services these associations offer and, more specifically, the offers its members contribute to the system whether it be in terms of time or in terms of goods. The LETS money cannot be converted into the national currency and must remain within the LETS system. (Kim et al., 2016).

The main aim of Local Exchange and Trade Systems is defined in various constitution documents published by associations of LETS:

- "To stimulate the creation of social and economic benefits by and for its members and the people of the locality; and
- To develop and encourage the experience of community in the locality through the establishment of a local exchange trading system." (Williams, 1996, p.87)

According to the literature, studies using different methodologies demonstrate that LETS tend to have more of a social impact on the populations using it than an economic one. The projects also need to be large enough in order to have a significant impact. (Fare & Ahmed, 2017).

The LETS were initially introduced in the 1980s and had an increasing popularity up until the mid-1990s. In some countries, nationwide organizations regroup the different local LETS, such as *Lets link UK* in Great Britain, *Selidaire* in France. The commonly admitted currency and value count is time, under the form of hours spent working, but it is not a general rule. (Blanc, 2011)

The Argentinian *Trueque* system was also a form of community currency many regions of the country used during times of economic hardships from 1995 until its downfall in 2002. These would be set up through weekly market places where participants would come with the goods they would like to sell. A value through a virtual community currency was given to each good. The participants could then buy goods using the value given to their own. At the end of the session, the residual values were written down and then entered into a database. (Saiag, 2014).

2.2.5 Local currency

A local currency is a type of community currency that can only circulate and only has value in a specific and determined geographic area by contrast to community currencies. Blanc (2011) defines specifically local currencies:

> *A first type of non-national and not-for profit currency schemes primarily a territorial purpose, aiming to affect monetary relations in a geopolitically-defined space. This emphasized the role of territorial actors and activities when building such a scheme, and the desired outcome of local resilience or development. They are not oriented toward a sovereignty purpose; on the contrary, they are fully respectful of the national monetary sovereignty. In any case, they serve first the purpose of defining and strengthening a territory and, eventually, the public local authority which claims a form of control on this territory. This focus on the role of a controlling center which pumps out money and simultaneously captures resources. For they pursue firstly territorial purposes, those schemes can be thought and implemented with loose reference to community and economic issues. Those currencies can be coined local currencies.* (p. 6)

Also, other than their geographical limits, local currencies most generally adopt a paper-form (Kim et al., 2013). Some local currencies have recently developed e-payment systems (Rogers, 2013) but this can always be transformed and represented by paper currency.

Finally, and most importantly, local currencies are usually backed by national currency and not by the goods and services they give access to. Local payment systems run alongside the national currency (Kim et al., 2013). The fact that local currencies are backed by national ones represents the main difference between local currencies and Local Exchange and Trading Systems. Also, most local currencies are traded at a one-for-one rate with the national currency and a fixed exchange rate is maintained between them over time.

The aim of local currencies, as stated before, is to maintain the money from transactions within the local environment and avoid it fleeing to wealthy far-away investors and shareholders. To accumulate large amounts of local currency is of no interest to the holder as its value comes from its circulation within the local system. (Cohen, 2016).

This may seem surprising that local currencies exist as they serve the same purposes and functions as those that can be served by the national currency while carrying the risk of not being able to convert the local currency back to national currency for the user. It is thus important to note that the concept of local currencies is a difficult one to grasp for conventional economics where agents choose the form of currency that optimizes their yield or transaction costs. However, when it comes to opting for local currencies, agents are not only taking into account the monetary aspects of their selected currency but also take other motivations into account such as economic, social or environmental aims. (Fare & Ahmed, 2018).

3. History and trends

3.1 History of money

Money, according to an inclusive definition, has existed in human history for approximately 3000 years. Prior to that, researchers assume that barter was the only available medium of exchange. However, populations used easily tradable goods as a distant form of currency, such as salt, weapons, metal or hunting goods.

In about 1100 BC, in Asia, coins were minted from precious metal which are considered to be the first coins similar to the ones we know today. Official currency then made its debut approximately 500 years later. The different coins of this currency had different values and were made from precious metal. The value of these coins was linked to the amount of precious metal each one contained. Around the 7th century AD, the Chinese civilization was the first to develop fiat money and banknotes, a much lighter and practical alternative.

It took another 500 years for paper currency to be introduced in Europe. It was originally initiated by the creation of letter of change by Italian bankers during the 13th century. This private form of money could be traded for their value in precious metal coins at the bank or private institution that had issued them. Letters of change facilitated commercial exchanges throughout all of Europe. Governments of European countries only started to get involved in the 17th century, first in the North American colonies due to a lack of official coins, and then in their home country.

Progressively this paper money encouraged international trade. A currency exchange market governed by banks then became inevitable. The relative value between currencies was mainly given by the stability of the government or of the country as a whole. Central banks then become the predominant actors in the field of money and monetary policy.

The next big revolution in the money world appeared during the beginning of the 21st century in the form of mobile payments and crypto-currencies. The impact of these revolutions are at this day, not fully known or grasped. However, the development of local currencies and their global counterpart which can be found in crypto currencies underline a new relationship between currency and sovereignty which was previously mainly managed at a national level. (Aglietta et al., 2016).

3.2 History of local currencies

The new trend surrounding local currencies gives a false sense of novelty. In historical times, before the generalization of the *etalon-or* in France for example, during the 19th century, local currencies were the norm whilst a common national system was the exception, excluding a few notable common currencies such as under the Roman empire or during Charlemagne's reign (Cohen, 2016). A common currency was created for the only purpose of comparing and exchanging local currencies and for far away trading. The value of currency exchanges was determined by the amount of precious metal within each coin. Alongside this system that covered large parts of Europe, local and regional kings and lords minted coins for exchanges within the borders of their lands. These two systems coexisted as local and national currencies coexist today. Gradually, the multiplicity of monetary systems was considered to hinder efficient exchanges and pricing. Nowadays, many authors and economists argue against this belief. (Blanc & Centre Auguste et Léon Walras, 2006).

Another notable example of local currencies were the ones used in the United States of America at the time when it was merely a group of British colonies. These alternative payment methods appeared in answer to the scarcity of official British money due to an important trade deficit. A majority of the thirteen colonies issued bills of credit with a predefined exchange rate with the pound sterling in order to facilitate commerce and even to collect taxes. These colony currencies existed from the end of the 17th century until the late 18th century. (Peacock, 2014).

In France, before the revolution, another type of community currency existed. They were called "méraux" and consisted of small coins of copper or lead often handed out by religious chapters. Initially, they were designed to pay for the presence of monastics at prayers but they were also often handed out outside of the religious community to the poor or to people providing work force to the monks. The *méraux* could then be used to buy basic goods within the community and sometimes also outside of the religious community, in places that sold monastic products. This type of currency was often used in periods of money shortages. (Blanc, 2006).

After the 19th century and the creation of more global monetary systems, local currencies went out of fashion (Blanc & Centre Auguste et Léon Walras, 2006). They then reappeared mainly

during economic crises and in wartimes when money was scarce and people needed new ways of payment outside of the national and exhausted monetary system.

At the start of the first World War, many places in France experienced a shortage of money due to an important increase in the price of materials needed to mint coins and to people stocking money in the face of uncertainty. Many Chambers of commerce and some savings banks urgently issued local currencies in order to keep the local economy running. (Blanc, 2006).

When the Great depression hit most parts of the world in the 1920s and the 1930s, many local currency experiments were initiated. The reasons for the need for these local currencies differed between the different countries. For example, Germany was facing hyperinflation in the 1920s whilst the United States were experiencing deflation at the start of the 1930s, both exposed to an urgent need of renewed economic activity and dynamism. (Blanc, 2006; Peacock, 2014). The aim of creating local currencies at that time was to counteract the scarcity of traditional money. Some local money emitters even took the concept one step further by taxing the money that was not circulating, as hoarding already scarce money only worsened the existing problem. This system was inspired by Silvio Gesell's theory on melting money and well-known examples of such moneys are the *Wara* in Germany and the currency implemented in the village of Wörgl in Austria. These two currencies were also implemented with the aim of fighting sky-high unemployment and both were successful in that way. The two experiments only came to stop after a decision of the central bank which had started to become apprehensive of these almost too successful decentralized systems. (Blanc, 2000, p. 148-155; Daniel, 2010).

One of the most famous local currency that emerged from the Great depression period and which still exists today is the Swiss *WIR*, which is derived from *Wirtschaftsring-Genossenschaft* (Economic mutual support circle) (Lietaer, 2001). It is exclusively open to SMEs and regroups over 70 000 of them throughout all of Switzerland. The bank that emits this currency was created in 1934. In the beginning it was called the *WIR Economic Circle* but is nowadays known as the *WIR-bank* which is a fully-functional commercial bank since 2000. At the time of its foundation, it was part of a larger group of initiatives created with the aim of encouraging exchange between small and middle sized enterprises using non-physical money. The idea for this particular banking system came from Silvio Gesell, an economist who saw in inactive money the source of money shortage which leads to numerous other

issues in the economy. Until 1948, inactive money held on the *WIR* bank accounts was subject to a tax whilst zero-interest credits were handed out. The system then changed to perceive a minimal interest rate on loans and dismissed of the inactivity tax. Through the *WIR-bank* SMEs can obtain low-interest loans as money *WIR* money is created at minimal cost by the bank. In exchange for these low rates, SMEs can only spend the sum in other companies that are part of the *WIR* network. The *WIR* system thus encourages trade between members of the network. Throughout the years, some studies have underlined that the *WIR* currency is counter-cyclical and receives more attention in times of economic difficulties. (Banque WIR, n.d.; Stodder & Lietaer, 2016).

Most of the pre-war local currencies, even in countries where they were not banned, did not survive through the flourishing economy and thus low unemployment rate induced by the necessary reconstruction after the second World War (Lietaer, 2001).

The next big step in the history of local currencies was the creation on Local Exchange Trading Systems. The first one was developed in Vancouver, Canada in 1983. In an economically deprived area with high unemployment rate, it allowed to organize and rationalize the existing barter between inhabitants. Unfortunately, after two years the *Vancouver LETS* had to be abandoned due to the financial difficulties the organization was facing. However, the initiative had not gone unnoticed and many similar initiatives were gradually created in most developed countries, mainly in deprived areas with high unemployment rates (Privat, 2014). In some countries, organizations developed a network between the different LETS at a national level. In these systems, currency is created through exchange between members. These systems led to the creation of time banks which use hours of work as their currency and then finally, to the creation of local complementary currencies as defined previously in this thesis. The support of local governments is the most recent step in the creation of local currencies (Blanc, 2011).

Even though local currencies were not totally forgotten, they received regained interest after the 2008 financial crisis (Fourel et al., 2015). Since then, the aim has stopped being exclusively economic and environmental concerns have been playing a larger role in the creation of local currencies (Blanc, 2011).

Surprisingly enough, community currencies have a much stronger presence in countries where capitalism has a stronghold rather than in poorer and less developed countries. In a way,

capitalism and local currencies appear to go hand in hand. This shows that capitalism and alternative currencies are not opposed and can even work well together, in complementarity. It also demonstrates the reducing power of states to control their own economy. This capacity is now becoming more fragmented as the economy becomes more globalized. However, the sharing of power does not only extend upwards towards other countries and supra-national instances but downwards as well, to local communities and organizations. (Blanc & Centre Auguste et Léon Walras, 2006 p. 147-148)

3.3 Creation of local currencies

Within local currency systems, money can be emitted by several actors with different roles or purposes. The first category regroups organizations that create local currencies with a lucrative aim. A famous example of this type of lucrative and local currency is the Swiss *WIR* emitted by the *WIR-bank*. It was initially created before the second World War, to counter a bearish economy by encouraging exchanges between small and middle size Swiss companies and discourage sleeping funds in bank accounts. This countercyclical system has been imitated around the world, for example in France and in the United States. The aim of these alternative currencies is to increase the circulation and thus the profit of companies participating in the system. (Blanc, 2000)

Local currencies can also be created and maintained by local authorities. Money is then emitted through public expenditure rather than through a banking system. There are two main reasons to public local currencies: a desire for more independence or the need for liquidity in times of economic downturns or lack of currency. (Blanc, 2000).

Local governments sometimes show their will for autonomy from the country in which they stand through the creation of a local currency which underlines the difference between the region and central government. (Blanc, 2000).

Finally, local currencies are sometimes emitted by groups of citizens or social organizations. Their aim is usually social or environmental rather than to make profit. (Blanc, 2000).

More explanations regarding the creation of local currencies based on monetary economic theory will be given in the following section. Also, examples and more details on the different

reasons and context in which local currencies emerge will be developed in the section of this thesis dealing with the emergence factors of local currencies.

3.4 Legality of local currencies

The legal aspects of local currencies vary from country to country but usually, central states and governments are not strongly opposed to the creation and circulation of local currencies. In most countries, the legal guidelines are at best vague but are most often just absent. Additionally, there often is an exemption from banking obligations or it is possible to circumvent the law. Generally, countries do not follow a strong and clear political line regarding local currencies (Fourel et al., 2015). However, an increasing number of local currencies are receiving support from the local authorities. One of the strongest and most famous example is the mayor of Bristol, in the United Kingdom, who takes the entirety of his salary in *Bristol pounds*. Some council employees also take part of their salary in the local currency. The locality also accepts taxes to be paid in the alternative currency. (Rogers, 2013).

3.5 Survival of local currencies

Local currencies may seem like a wonderful project for citizens in search of an alternative way to live and to buy. However, it has to be noted that in many cases, local currencies do not survive in the long run. Even some of the most famous and praised community currencies, such as the *Ithaca Hour*, saw a fall in their circulation after a few years.

Several reasons to this lack of continuity exist. First of all, local currencies tend to have a deficiency of liquidity as they can only be used in participating stores and businesses. This limits the spending options of consumers. Secondly, trust in the currency can be an issue as it is not backed by the state or the traditional banking system. This increases the perceived risk and leads members to limit the amount of local bills they actually keep in their wallets. Lastly, transaction costs may drive citizens away from the alternative currency given that they can still support local businesses using the national currency without the hassle of maintaining two currency systems. (The Economist, 2017).

Kim et al. (2016) pinpointed several conditions that tend to lead to the survival of local currency movements such as a small population or an isolated community, a penchant in the area for alternative economic movements in the previous years and low income. The author also came up with strategies to help encourage the pursuit of the experiment: sufficient initial funding, a large number of businesses involved, good leadership strategies, communication and realistic ways to continually finance the organization.

3.6 Users of community currencies

Several studies have focused on the profile and the motivations of users of local and community currencies. However, none have tested the environment in which these emerge on a larger scale and more specifically in the case of local currencies.

Regarding community currencies, which follow the LETS system, in France, the motivations of the participants to be a part of their local movement has been tested as well as the socio-demographic characteristics of these participants.

The main study that was conducted on the socio-demographic users of LETS was assembled in a book under the direction of Jérôme Blanc & Centre Auguste et Léon Walras (2006). The survey concluded that it was mostly women that participated in the exchange systems, that 40 to 59 year-olds were the most represented age category with 63,3% of participants and that community currencies were mostly created in urban areas. According to the study, the main motivations to be a part of a LETS are to defend a certain type of society, to meet new people and develop relationships and to participate in the exchange of goods and services. A majority of LETS are created in the wake of an individual initiative.

In a study, Helène Privat (2014) surveyed 957 members of French LETS on their individual motivations to participate in the system. The main incentives of the participants were: distract themselves, acquire goods and services at a low price, offer an answer to alternative ideals, intellectual enrichment and create social connections. The general motivation to be a part of a LETS is mostly influenced by the type of involvement in the system and the number of years as a member of a LETS. When looking at psychosocio-economic determinants, those that have an effect on the drive to be part of a LETS are income, altruism, the importance of the

social network and frugality. Altruism and frugality influence positively stimulus to take part in local exchange while the other two determinants influence it negatively.

3.7 Currency ecosystems

For some authors, like Bernard Lietaer (2001; 2009), the series of economic crises our financial and monetary system has experienced in the past decades shows the structural weaknesses and instabilities of the system. As in nature, Lietaer advocates for more diversity in order to maintain a certain balance. An ecosystem of moneys and currencies, where each one plays a specific role, would be preferable to a monoculture that currently exists: conventional currencies created through bank debt. Because the system lacks diversity, it becomes more vulnerable and lacks resilience. However, resilience is opposed to efficiency so a fine equilibrium between too much and too little monetary diversity must be attained. Lietaer pinpoints Switzerland and its WIR as an example of resilience. In the event of an economic crisis, the country is better off than its closest neighbors thanks to the countercyclical mechanism that help counter the effects of the crisis. (Stodder & Lietaer, 2016).

Lietaer (2001) suggests for countries to have a national or global currency for international trading, regional and local currencies for smaller scale exchange as well as functional currencies that can only be used in a predefined and specific context. These functional currencies should each aim to solve a particular societal issue such as sustainable development or the aging of the population. This allotted currency helps give a more meaningful course for the economy to follow. The author recommends functional currencies to be organized at a city level. The aim of these different currencies is not to enter into competition with one another but rather to act as complements in order to fulfill the objectives that traditional national currency has not been designed to fulfill and thus, can never attain.

The banking system will be the most difficult actor to convice. It is always challenging to persuade a sector to give up its monopoly, in this case on the creation of money and on the control of transactions. (Lietaer, 2009)

4. Theory of money and currency

This section is devoted to explaining the main theories linked to money and currency in general. The last section of this chapter is devoted to these general concepts applied to local currencies in order to pinpoint the similarities but also the differences between national currency and local currency from a theoretical point of view.

4.1 Demand and supply of money

The supply and demand of money work in similar ways as the supply and demand of other goods or services. The main difference with the money market is the shape of the supply curve. The price of money can be seen in terms of interest rate.

The demand for money is the proportion of the wealth households want to have in the form of money and not in the form of another asset which can take many forms: goods, stocks, bonds, … This quantity of money to which people decide to hold on to is determined by the relationship between interest rates perceived from having an asset and the one perceived from deposits in the bank. When the difference between the interest rate of assets and the interest rate of deposits is large and positive, the demand for money will drop as people will want to invest in the alternative asset rather than hold on to money. Usually when interest rates of deposits increase, the spread between asset and deposit will increase. Overall the demand for money will drop. The shape of the demand curve then resembles that of other demand curves, using interest rates in place of price. This curve can be shifted by other determinants such as income, GDP, inflation, speculation, or transfer costs. (Rittenberg & Tregarthen, 2009).

According to Rittenberg & Tregarthen (2009), “the supply curve of money shows the relationship between the quantity of money supplied and the market interest rate, all other determinants of supply unchanged.” Central banks are in charge of controlling the amount of money banks have in their reserves. The money supply curve is vertical because the amount of reserves present in the banking system is fixed through central bank policies. When central banks modify their policy, it shifts the supply curve accordingly.

Like all markets, the money market has an equilibrium for a certain quantity of money at the interest rate at which supply and demand meet (Rittenberg, 2009). As can be observed in Figure 1, when money supply increases, interest rates tend to decrease in order to obtain a new equilibrium which satisfies the demand and supply curve.

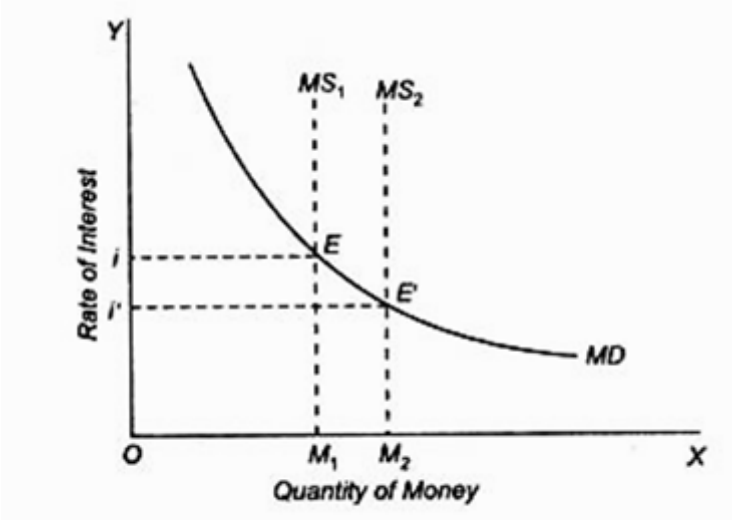


Figure 1. Effect of Increase in Money Supply on the Rate of Interest

Note. Reprinted from "Money market Equilibrium in an Economy" by Mukher, S., no date, Economic Discussion, retrieved 2018, April 12 from http://www.economicsdiscussion.net/money/money-market-equilibrium/money-market-equilibrium-in-an-economy-with-problems/10500

4.2 Function of money

Money is often defined based on the different functions it occupies in the society. The three commonly recognized functions of money are a medium of exchange, a store of value and a standardized unit of account. Other functions are also described by some authors such as an instrument of speculation, for example on the foreign exchange market. Money is also considered by some as a tool of empire which allows to group together different cultures and economies and which holds a strong symbol for those using the currency. (Lietaer, 2001, p. 332-333).

The way money is used and organized in a society steers the habits and the emotions linked to money of the community. A good example of the influence of the nature of money on

behavior is, in the era of national currencies, trade with fellow citizens is preferred to trade with foreigners. (Lietaer, 2001, p.4-5).

4.3 Value of money

Nowadays, the value of national currencies lies exclusively in trust as it is not backed by gold reserves anymore. The currency of most countries is now called fiat money which means its value is not linked to precious resources but rather to policy dictated by the country's central bank. What actually gives bills and coins their value is their scarcity. If a central bank was to start printing an excessive number of bank notes, these would suddenly be worth less as they would be much more common and accessible. There is a fine balance between the creation of new money and the growth of the economy central banks need to maintain in order to avoid strong inflation or deflation. (Levinson, 2014)

The system works in the same way for money on bank accounts. However, instead of overworking the printing machine, the central bank adjusts the amount of money in circulation through the interest rates it applies on its loans to commercial banks.

4.4 Creation of money

Currently, money, which differs greatly from wealth, is created through debt and more specifically by debts owed to banks which is added to client accounts and which increases the total amount of money available within the system. Money is created when banks lend money and disappears when money is reimbursed. Creating money becomes then as simple as writing a certain amount of money on someone's account. (Blanc & Centre Auguste et Léon Walras, 2006, p. 123-124).

However, as there are a lot of rules and regulations regarding reserves within the banking system that allow them to lend to clients, creation of money depends a lot on central bank policy. A lot of money is created through loans made by the central bank to commercial banks which in turn lend to their clients. (Xiong et al., 2017).

4.5 Circulation of money

Money circulates through the economy in a circular movement known as the circular flow of income. Money passes from households to firms and vice versa through the factor market where households lend their production factors to firms, also known as income, and the goods and services market where households buy products from firms. When quantifying the amount of money in circulation, only one of these aspects need to be taken into account in order to avoid double counting. (Khan Academy: Circular flow of income).

The velocity of money circulation is a measure of this circulation and can be defined as "the average number of times a unit of money changes hands in an economy during a given period – normally measured by dividing the total amount spent (GDP) by the amount of money available (money supply)" (Financial Times, n.d., b).

When money circulates locally, for example, with local currencies, money tends to circulate much faster than in a broader economy. Local communities in which money passes faster from hand to hand, receive greater income as more money is available for spending. (Michel & Hudon, 2015)

4.6 Inflation

Inflation measures the growth rate of price levels and corresponds to the growth rate of money minus the GDP growth.

$$Inflation = \frac{\Delta Money}{Money} - \frac{\Delta \mathrm{GDP}}{GDP}$$

Money supply is managed by central banks and money demand depends on the economic growth. When a central bank issues more money than the demand, there is "too much" money in the system and money loses its value. This encourages spending as the longer households and firms hold on to it, the less value it has. The central bank is responsible for maintaining an equilibrium between money demand and money supply and thus, for keeping inflation in check. (Burda & Wyplosz, 2009).

Inflation in itself is not a bad thing but it can become a serious problem when it gets out of hand and leads to hyperinflation. Hyperinflation is when monthly inflation rates are superior to 50%. It often occurs when the central bank in a certain country increases the emission of money when it is struggling to meet its financial obligations. This creates an imbalance between the money supply and the demand for money. (Burda & Wyplosz, 2009).

There are several causes to hyperinflation and its prolongation in time. The government and the policies put in place are often not foreign to the start of an inflation crisis. Once the crisis is well underway, the natural behavior for people with money reserves is to invest in assets which further pushes prices upwards. Debtholders have no interest in seeing the end of the crisis as their debt reduces with inflation. Finally, as the demand for money increases, an increasing volume of money is printed and the vicious cycle is launched. (Coomer & Gstraunthaler, 2011).

To summarize, hyperinflation occurs when the economic and political situation in a country are dire.

Notable examples of this hyperinflation are Germany before the second World War as well as Zimbabwe throughout the first decade of the twentieth century (Coomer & Gstraunthaler, 2011). More recently, Venezuela has been experiencing this phenomenon as well.

4.7 Functioning of local currencies

As a general rule, local currencies work more or less like conventional money as its essence is similar, only the territorial circulation is limited. There are however a few important differences between local and national money systems or specificities that should be pointed out.

First of all, this has been demonstrated for community currencies but probably also applies to local currencies, is the fact that these alternative money forms encourage transactions that would otherwise not have happened. This increases the overall exchanges that occur within a society and thus increases the total volume of economic activity, creating more wealth for the community compared to using exclusively national currency. (Lietaer, 2001, p.177).

When looking more closely at the different functions of money, these have been criticized alongside the negative effects of capitalism. Some believe that the function of reserve should be abandoned or at least limited as it is source of speculation and inequalities. Local currencies are a more practical way of limiting the accumulation of money. Local currency characteristics are also largely detrimental to complex financial operations and thus speculation. This avoids the formation and then the burst of speculative financial bubbles which often lead to financial crises as many examples in history have shown. (Fourel et al., 2015).

Some local currencies were created in the wake of Silvio Gesell's theory on melting money which would encourage a fast circulation of money rather than its hoarding. When money circulates faster in the economy, 1 unit of currency will create more wealth as more people will have the opportunity to spend it. The local currency experiments in the pre-war era put the philosophy of Silvio Gesell into practice through stamps that needed to be applied to the bills every week or every month in order for it to maintain its value. This meant that whenever households received such money, they were encouraged to spend it quickly, effectively circulating the local currency a lot faster than national currency. (Lietaer, 2001, p.153-155). It must be noted that not all local currencies use this system. Others simply rely on zero-interest rates to try to discourage users from storing money on a bank account or in their wallets.

Local paper currencies are considered as fiat money as their value is given to them by the trust locals are willing to put into it. In a sense, it is backed by national currency which is deposited on a bank account for an amount equivalent to the amount in circulation. This guarantees the one-to-one exchange rate and ensures the value of the local currency. As national currency is fiat money, it can be considered that the local currency derived from it also depends on trust in the economy. Having a fixed exchange rate between local and national means of payment has the advantage of simplifying pricing and valuation but has the risk of facing the same difficulties as the national currency in the event of a crisis. (Lietaer, 2001, p. 217, 232-233).

5. Model and indicators

5.1 Model specifications

This section will be devoted to the model and the different factors that affect the creation of local currencies. These factors make up the base for the indicators used in the model. The outcomes of the two models will be studied more specifically in the section devoted to data analysis.

Each section in this chapter represents one hypothesis for a factor that could influences the creation of a local currency. These hypotheses were based on the literature review presented in the previous chapters as well as on examples of existing and extinct local currencies. I will test each hypothesis using one or more indicators. The aim is to determine the relevant factors that influence the number of new local currencies in a given region or a given year.

This will be done through two multiple linear regressions. The first one looks at the regional aspects of the creation of local currencies. The second one is a time series analysis which will evaluate the evolution of national indicators against the number of new local currency projects launched. Each regression will give the expected number of local currencies within a certain time frame or region depending on the value of the different independent variables (Hill et al., 2012).

Summary of the hypotheses for the two models that will be tested in the data analysis section are available in Figure 2 and Figure 3.

Regional model		
Hypotheses	Sub-hypotheses	Indicator
Demographic	Population	Population size
Social	Wealth	Income per capita
	Social isolation and poverty	Long term unemployment Poverty rate
Cultural	Identity	Presence of independence movement
	Environmental awareness	Electricity consumption Organic agriculture

Figure 2: Hypotheses for the regional model

Time-series model		
Hypotheses	Sub-hypotheses	Indicator
Economic	Economic crisis	Country debt Unemployment
	Lack of liquidities	Money in circulation Inflation
Social	Wealth	Income per capita
	Social isolation and poverty	Poverty rate
Cultural	Environmental awareness	Electricity consumption

Figure 3: Hypotheses for the time-series model

The structure of this section is organized as follows. Firstly, the indicators common to both models will be presented. Then the specific indicators of the national model will be detailed. Finally, the regional indicators will be explained in the last section. All of the parameters are established through theory found in the literature and through real-life examples.

Regarding the basis of the model, even if it is imperfect, a multiple linear regression was chosen for this analysis for several reasons. The aim of the model is to estimate the number of local currencies that emerged in a year or the number of local currencies present in a certain region. First of all, the dependent variable, the variable that the model tries to explain, does not need to express a percentage or an elasticity and thus, it is not necessary to measure it with a logarithm. Using a logarithm for the dependent variable also makes it harder to interpret the results when applying the model to a new situation. Regarding the independent variables, it is common to use the original form when the figure depicts a percentage and the logarithmic form when looking at large integer values such as population or amounts of money. This rule of thumb has been used in the regional model as it contains a mix of very large number as well as percentages. Population, income and energy consumption cannot take negative values so these independent variables are well adapted to a logarithmic form. Also, it is very unlike that the value of these data will be comprised between 0 and 1 which would change the sign of the data and change the interpretation of their coefficient. However, this method was not selected for the national model as it is only composed of percentages with the exception of electricity consumption whose figures are, in this case, relatively small. It must be noted that using logarithms prevents the model from making use of negative data. (Wooldridge, 2009, p. 190-192).

A quadratic model was excluded in this case as they are “used quite often in applied economics to capture decreasing or increasing marginal effects” (Wooldridge, 2009, p. 192) which does not apply to the presented models.

The use of interaction variables allows to take the marginal effect of one of the independent variable on another into account (Wooldridge, 2009, p. 197). However, including an interaction effect prevents the interpretation of the stand-alone parameters (Falissard, n.d.). Interactions effects were not taken into account in the two models to allow a stand-alone study of each indicator.

The statistics program used to run this model will be an extension of R: R commander (Rcmdr)[1]. R is an open source statistics language which provides tools for statistical computing and graph creation. (The R foundation, n.d.)

To find the most significant model in each of the two scenarios, the model including all the variables will initially be run. The model will then be run again, removing the least significant variable. It must be noted that for some variables, it is not possible to reject the hypothesis of irrelevance due to limited data rather than a false hypothesis (Hill et al., 2012).

The model that then combines the most criteria out of the following will be selected for analysis:

- Lowest AIC (Akaike Information Criterion)
- Lowest BIC (Bayesian Information criterion)
- Highest Adjusted R-squared

(LSBA, 2014)

The next step is to verify if the model chosen by the previously described method has a global significance. In other words, the hypothesis, according to which all coefficients are equal to zero, can be ruled out with sufficient certainty. To verify this, the p-value of the model as a whole must be smaller or equal to 5%. If this is not the case, the next best model will be chosen.

This process will be used for both the time-series and the regional model.

5.2 Common indicators

5.2.1 Wealth

This section refers to the wealth of individuals and not to the wealth of the country as a whole. The aim is to verify if a slump in citizens' income, which affects their purchasing power, will affect the emergence of local currencies. The test here is not to look into poverty levels but

[1] R and Rcmdr can be downloaded freely from https://cran.r-project.org/mirrors.html

rather to see if a variation of revenue has an impact even if the downturn does not lead to insufficient means or social isolation.

An example of local currencies that was used to enhance purchasing power was the monetary diversity present in Argentina from the 1990s until 2001. A specific type of social currency was used in that country at that time in order to increase the access participants had to goods and services: The *Trueque*. It was initially designed to exchange excess production between neighbors. The system then became more structured and organized. As more participants joined local *Trueque* initiatives, the projects moved essentially from a LETS to a scheme closer to local currencies, as defined previously. (Saiag, 2014).

In this example, it is difficult to separate the effects of the loss of purchasing power from the general economic and currency crisis Argentina was experiencing at that time. However, as the *Trueque* was initially established to trade surplus, it demonstrates that the aim was firstly to increase access to more goods and services in the midst of an economic downturn, rather than to fight poverty directly.

To depict wealth in the time series model, the relative measure of the annual household disposable income growth is used. Regarding the regional model, the absolute measure of average disposable income is taken into account in order to allow comparison between the different regions. This phenomenon is closely linked to the one depicting poverty as well as economic crises.

5.2.2 Social isolation and poverty

Social inclusion was a particularly important aspect of community currencies such as Time banks and LETS. As community currencies can offer an access to some form of economic system to citizens that have been marginalized, they are more likely to emerge in places where poverty and unemployment are high (Collom, 2005). For example, time banks have been shown to nurture unofficial social assistance and to help include marginalized groups back into the community through valued and reciprocal volunteer work. Small volunteer jobs allow to build new relationships based on trust and can be an important first step on the path to being an active member of society through a focus on participants' skills rather than their challenges

(Seyfang, 2003). As community currencies share some characteristics with local currencies, it is interesting to test if social isolation also plays a part in the creation of local currencies.

Long term unemployment is used here as an indicator for social isolation and poverty. It was preferred to general unemployment because it pinpoints a truly marginalized segment of society rather than people that are still an active part of society but are experiencing a short term disruption.

Long term unemployment is only taken into account in the regional model because this indicator reflects the state of a population in the long run. A yearly evolution is not well adapted to this long term indicator and as such, has been left out of the time series model.

The annual unemployment rate is part of the time-series model but under the economic crisis hypothesis as it represents a different reality, linked more to the state of the economy than to social exclusion.

5.2.3 Environmental awareness

Several green political movements use local currencies as a tool to put their ideas into practice. (Guyomart, 2013) For example, the *Transition Towns*, which originated in the UK in 2005 and developed into the worldwide *Transition Network* in 2006, aim to change consumer behavior by promoting the creation of local currencies but also community gardens or school workshops. As most local currency project values, the goal of the movement is not only environmental but also social through the creation of more tight-knit communities. (Transition Network, 2016).

Some local currencies directly advertise a more environmentally-friendly way of life when trying to develop its user base. An example of a local currency with an eco-friendly aim is the *Totnes Pound* which was launched in the British town of Totnes. The advertised aim of this local currency is to encourage social equity and local redistribution but also to have a positive impact on the environment. Totnes is a member of the *Transition Towns* movement which focuses on reducing carbon through collective actions at a local level and their local currency is one of the means used to reach for that goal. (Granger et al., 2010)

Another example of a local currency with an aim to have a positive impact on the environment is *Le Talent* from Louvain-la-Neuve in Belgium. The organization states avoiding pollution from long and useless transportation of goods as one of the main profit from using the local currency. The other two focus on supporting the local economy and increasing the purchasing power of less wealthy inhabitants. (Le talent, n.d.)

Also, a study in the United States has shown that community currencies emerge in very heterogeneous cities but seem to concentrate in areas considered as more liberal and pro-environment, such as California (Collom, 2005).

In order to represent environmental awareness, electricity consumption of households will serve as an indicator in both the national and the regional model. For both models, the consumption is measured in direct terms because weather adjusted data is not available specifically for household consumption. Analyzing electricity consumptions allows to have a more tangible measure of environmental awareness that is not biased by the image people want to give of themselves but rather of their actual efforts put into reducing their environmental impact. However, this is not a perfect indicator as household may also reduce their electricity consumption for other reasons such as spending less money which is not linked to environmental awareness. In the regional model, the average household electricity consumption per inhabitant is used as an indicator. This allows to ignore the size of regional population in the electricity indicator.

As environmental awareness is not exclusively based on energy consumption, another indicator is used in the regional model: the extent of organic agriculture. Many people try to limit their environmental footprint through the food they eat and an increasing number of consumers are choosing organic products (Alavoine-Mornas & Madelrieux, 2014). The consumption side of organic agriculture in each region is difficult to measure precisely. On the other hand, data on the production side is more accessible. Farmers, like citizens, have a certain degree of environmental awareness which partially encourages their choice for conventional or organic agriculture. Also, if more buyers want to consume organic products, according to basic supply and demand mechanisms, the number of organic farmers should increase as well. All in all, the percentage of organic agriculture in each region is used to partially assess the local level of environmental awareness. This indicator is however imperfect due to import and export across regional and national borders.

5.3 National indicators

5.3.1 Number of local currencies

The year in which a local currency is created can have two different meanings: the year in which the project is launched or the year in which the currency is effectively emitted for the first time. As it can take some time for a project to materialize, the launch date of the project is taken into account and not the date of the first currency emission. This allows to be closer to the macro-conditions in which citizens felt the need for a local currency in their area.

5.3.2 Economic crisis

This hypothesis aims to test if economic crises and downturns affect the creation of new local currencies.

Many local and community currencies have been created in the wake of economic crises. Some famous examples are the *Totnes Acorn* (LETS) that was set up in the United Kingdom during a time of economic recession (Granger, 2010), the Argentine *Trueque*, or the many community currencies organized throughout Greece after the 2008 crisis (Arte Futurmag, 2014).

The world's largest community currency, the Swiss *WIR*, is proven to be counter-cyclical. This means that companies which are part of the *WIR* network, increasingly call upon the currency in times on economic difficulties. The dual currency system improves the overall stability and resilience of the Swiss economy. (Stodder & Lietaer, 2016).

The national deficit in percentage of the gross domestic product (GDP) is used to measure the presence and the intensity of economic downturns. Having it as a percentage of the GDP allows to obtain the evolution of the deficit while ignoring the general trend of the economy from previous years. A link between economic crisis and deficit exists. For example, the 2008 financial and economic crisis turned into a deficit crisis in some more vulnerable countries in 2011. (Bodislav, 2012).

Another way to evaluate the presence of an economic crisis is the national annual unemployment rate in a country which is included in the model. Counteracting high

unemployment was an important decision factor when implementing local currencies during the economic crisis prior to the second World War, for example in Germany and Austria (Blanc, 2001, p. 148-155).

5.3.3 Lack of liquidities

The aim of this indicator is to test if local currencies emerge in the wake of liquidity crises in order to allow transactions to continue despite the lack of currency.

Throughout history, there have been numerous examples where the lack of cash has led citizens or private institutions to print their own money in order to maintain economic activity in their region. This can also sometimes be linked to economic crises which has been developed in the previous section. However, the overlapping of some factors will be discussed more in the limitations section.

As it has been discussed in the history section, the lack of liquidity was one of the main reasons for the creation of local currencies in the British North American colonies. Most often, they took the form of bills of credit to allow commerce in the absence of official currency. Some were used as ghost currencies in order to be able to estimate the value traded goods. (Peacock, 2014).

Later in history, during the first World War, in France, many local chambers of commerce issued notes and coins due to a shortage of money in circulation. This scarcity came from an increase of the prices of metals used for minting coins as well as citizens holding on to cash due to an increased uncertainty. (Blanc, 2006).

In these two examples, people were not necessarily in a difficult financial situation but the lack of money in circulation made trading and commerce difficult. This led to a necessity of creating a local mean of payment in order to allow the economic sphere to proceed with its usual occupations.

Hyperinflation was one of the main causes to the loss of purchasing power at the end of 20th century in Argentina. Different policy attempts were made to try to stabilize the price increase but they generally failed. Anticipation of exchange rate and replacement of the national currency with foreign currencies accelerated the inflation crisis. (Marie, 2014).

As it has been discussed previously, Argentina experienced and extended Local Exchange Trading System throughout most of its provinces as a way to elude this strong price increase and the known consequences. The country was, at that time, characterized by a multiplicity of currencies. (Saiag, 2014).

Hyperinflation represents a dire economic situation and is often a visible sign of an economic crisis. Countries subject to this phenomenon often have very high deficit rate. Coomer & Gstraunthaler (2011) points out the different methods of reducing deficit. “A budget deficit can only be financed by limited means: by borrowing abroad, borrowing domestically, running down foreign exchange reserves, or by printing money.” (Coomer & Gstraunthaler, 2011, p. 313)

This shows that hyperinflation caused by an excessive printing of money is initiated by an already poor national economic situation. On the subject of local currencies, inflation and thus a lack of liquidities can also be linked with the previous point addressing economic crises.

The indicator used to measure liquidity is the quantity of cash in circulation, short term deposits and short term liabilities, also known as M3 when referring to money aggregates (OECD, 2018). This larger definition of money was used instead of cash in circulation because cards and smartphones are increasingly replacing cash in everyday use (Tee & Ong, 2016).

For countries of the Eurozone that as such, do not have their own currency to measure, the evolution of M3 within the entire Eurozone is taken into account. These numbers could be refined with each countries participation to M3 of the Eurozone when possible.

The second indicator used to measure lack of liquidities is inflation. When inflation is moderate, it does not usually impact strongly the cash reserves of a country as money emission is managed responsibly by the central bank (Burda & Wyplosz, 2009). The lack of liquidities issue starts to emerge when inflation gets out of hand and becomes hyperinflation.

In the model, annual national inflation rate will help depict the general hypothesis of a lack of liquidities. If inflation is within a moderate range, its impact might not be significant for the creation of local currencies. It may be interesting to study separately the rare occurrences of hyperinflation and their impact on the creation of local currencies.

5.4 Regional indicators

5.4.1 Number of local currencies

The number of local currencies accounted for in each region include local currencies in circulation as well as local currencies that have circulated but that have been abandoned recently. Local currencies that only existed under a project form are not taken into account as their effective emission is uncertain.

The idea behind including local currencies that have been abandoned is as follows: at the moment of their release, a need, in that region, existed for a local currency. As the focus is not on the survival of local currencies but on the conditions in which they were initially launched, it is still valid to take them into account, regardless if contextual factors have modified the desire for a local currency.

5.4.2 Population size

In the regional model, the population indicator was inserted in order to verify if the disparities of the number of local currencies between the different regions are due to a larger number of inhabitants. This indicator is important to take into account because the population size of the different regions can have important differences within a country and it allows to control for the logical assumption that more people would induce more local currencies.

5.4.3 Identity

Finally, money is a strong symbol of a state's authority on the economic spheres. It is used to create a national conscience through a symbol of national sovereignty. This is why some organizations use local currencies as a way to reclaim the symbolic place fiduciary money occupies in society and in the economy. When a local association takes the decision to emit a local currency, they determine according to common values what has the right to belong to the local economic environment. (Guyomart, 2013).

The *Eusko*, a local currency from the Basque country in France, is a good example of a complementary currency being used to underline and promote a strong regional identity. The Basque country is known for its desire for more autonomy as well as its formerly violent independence organization. *Eusko* is one of the most successful local currency in Europe thanks to the strong tie between the community and the Basque identity the *Eusko* inspires. The partnership between businesses, shops and the local currency is used as a symbol of their support of the Basque culture. In order to participate in the project, the store must comply with specific requirements such as the possibility to interact with clients in the Basque language or sell local Basque products. However, *Eusko* was not created for the sole purpose of identity and is also advertised as a way to promote the local economy and to have more environmentally friendly consumption habits. (Eutcheleku, 2017; Arte Futurmag, 2014)

Many regions have a strong identity and specific culture. However, some are willing to take it a step further and affirm their sovereignty by asking for autonomy or independence from the central authority. In order to rule out marginal independency movements, a binary indicator will be used in the model to indicate if within the region, there is an elected nationalist movement or not. This will allow to test if local currencies tend to emerge in localities with strong cultural identities.

6. Data

6.1 Scale

This thesis focuses on local currencies, as defined earlier, in circulation in France. The reason for this choice is that a network of local currencies in that country exists and has data on every currency that is part of the network. A large number of local complementary currencies are part of the movement which allows for more significant deductions. France also has a large quantity of easily available statistics on demography and economy which will be used in this thesis.

6.2 Methodology

Two different types of data had to be collected for this study. The first one was the number of local currencies and their location. This was done through the website of an organization which regroups numerous local currency projects throughout all of France*: Le réseau des MLCC* (Monnaies Locales Complémentaires Citoyennes, *Complementary Citizen Local Currencies Network*). This movement regroups local currencies that are looking to share common value, goals and experiences (Le réseau des MLCC, 2013). Although some local currencies might be missing from this data collection, the aim is to test the previously presented model rather than have an exact image of local currencies in France.

The second type of data collected is related to the indicators. Most of the data was collected from the *Eurostat* website, in the regional section as well as data from the French statistic institute (Insee) and the statistics center of the *OECD*. Other more specific sources were also taken into account, for example, the data on electricity was collected from the grid manager, *Rte* (Réseau de transport d'électricité). All this data is available freely on the website of the different organizations.

6.3 Data collection

The aim of this data collection is to test the relevance of the model previously described. It will also deliver coefficients for each of the indicators in the two models, giving an idea of the extent of their influence on the number of local currencies created in a certain region or over the course of a year.

The time-series analysis regroups data over a 10-year time period. This period is relatively short compared to the history of local currencies. The reason for this limited timespan is the restricted information available on local currency projects which are, by nature, marginal. Thanks to the internet and communication platforms, local currencies have recently started to regroup in order to exchange their experience and views. The MLCC network was launched in 2010. At that time, only one local currency within the current platform had already been launched. (Le réseau des MLCC, n.d., a).

The difficulty to study local currencies over a longer time period stems from the fact that new-generation community currencies have only started to regroup and to have visibility on the net a short time ago. Very few available records of previous local currencies exist, except in the memories of participants of extinct experiences. This explains the relatively short test period in the test of the national model.

In the regional model, when relevant, the latest available values for the different indicators were used. This may create a disparity between the reference years used but it helps to take the most recent situation into account as some local currency projects accounted for have been launched as recently as 2017. It has been decided to continue accounting for projects after the earliest data reference date in order to increase the number of observations used in this study.

6.4 Data description

Since 2016, metropolitan France is divided into 13 distinct regions. There are 59 local currencies in total throughout the different regions. The number of local currencies in each region spans from none in Corse to 10 in Nouvelle-Aquitaine. The most populated region is Ile-de-France with 1.2 million inhabitants and the least populated region is Corse with around

330 000 inhabitants. Disposable household income in 2015 ranges from 16 400 euros in Corse to 21 600 euros in Ile-de-France. Pays de la Loire is the region which has the lowest household electricity consumption per inhabitant whilst Corse has the highest. The lowest poverty rate is found in Bretagne with 10.80% and the highest is nearly twice as large in Corse at 20.30%. Only two regions foster elected independence movements: Corse and Nouvelle-Aquitaine. The region with the highest percentage of agricultural land dedicated to organic crops is Occitanie. Hauts-de-France has the highest long term unemployment rate at 6.31% of the active population.

The number of local currencies observed in the time-series model is of 52. The difference between this total and the one presented in the regional model comes from the fact that the *Roue* projects were created and launched together and are part of the same entity. They were only accounted for one time each in the time-series data because they are considered to be one single project. Otherwise, the data would have been biased in the year 2011 with an abnormally high number of local currency projects created. Also, there are two local currency projects, *Cep* and *Ostrea*, which had no data regarding the starting date of the project, only data regarding the launch of the currency. These two projects were thus not accounted for in the number of successful local currency projects launched.

When looking more closely at the year-comparison model, it can be noted that the government deficit was at its highest in 2009 at 7.2%. During the observation period, inflation ranged from 0.1% in 2009 to 2% in 2011 and 2012. The yearly evolution of M3 peaked in 2007 with an 11.08% increase compared to 2006. In 2007, the annual growth rate of household disposable income was the largest with 2.82% and reached its lowest in 2012 with a decrease of 0.32%. The At-risk-of-poverty rate is relatively stable throughout the observation period ranging from 12.5% to 14.10%. 2010 saw the most important electricity consumption whilst 2014 had the smallest.

In appendix 1 (regional data) and appendix 2 (time series data), the full details can be found for all of the indicators used in the two models.

7. Data analysis

7.1 Regional model

In this section, the selection of the most significant regional model will be detailed. The data obtained from this model will then be described and studied more closely, in comparison with the hypotheses formulated in the Model and indicators section. Finally, the validity conditions for the most significant model will be examined, such as normality of the residues and multicollinearity, in order to evaluate if the model provides Best Linear Unbiased Estimators which is the aim of a linear regression.

The model including all the factors needed to test the hypotheses for the regional analysis stands as follows:

$$Y = \beta_0 + \beta_1 \log(X_1) + \beta_2 \log(X_2) + \beta_3 \log(X_3) + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \epsilon$$

Where

Y is the expected number of local currencies in a region

X_1 is the regional population size

X_2 is the regional average income per capita in euros

X_3 is the average regional household electricity consumption in MWh

X_4 is the regional poverty rate

X_5 is the binary variable depicting the presence of an independence movement

X_6 is the regional percentage of organic agriculture

X_7 is the regional long-term unemployment rate

The βs represent the coefficients allocated to each of the corresponding independent variable and epsilon is the error or residual which represents the distance between the linear regression and the real value of the independent variable.

The model is then run in a statistical program in order to obtain a linear regression including all of the indicators. In order to obtain the most significant model, the different models are run and tested according to the model selection procedure describe earlier in the model specification section. Each column represents the model examined at each of the different steps of the model selection method, starting with the model including all the variables and then removing each time the least significant variable in order to identify the most significant model.

Table 1 *Coefficient values of the regional model*

Y: dependent variable

	(1)	(2)	(3)	(4)
Intercept	**104.104** **(84.506)**	55.8892 (84.0692)	-	-
$Log(X_1)$	**5.406**** **(1.699)**	3.4148*** (0.7401)	3.3438*** (0.7026)	2.7528** (0.8583)
$Log(X_2)$	**-24.832**** **(8.808)**	-15.2471 (8.025)	-10.3146*** (2.9334)	-3.4281** (1.4278)
$Log(X_3)$	**9.118*** **(3.483)**	6.6007 (3.5522)	7.6795** (3.0313)	-
X_4	**-55.275** **(54.319)**	-61.2314** (18.9025)	-59.1092** (17.8729)	-51.8209* (22.8451)
X_5	**2.119** **(1.852)**	4.3022** (1.6072)	4.2055** (1.5354)	5.284** (1.9106)
X_6	**31.781** **(15.087)**	41.5580*** (10.9445)	40.4835*** (10.3841)	48.9064*** (12.7404)
X_7	**-111.106** **(111.106)**	-	-	-
AIC	**47.9275**	55.6788	54.6027	61.0616
BIC	**52.2917**	60.1984	58.5574	64.4513
Adjusted-R^2	**0.8127**	0.7812	0.9226	0.8702
P-value of the global significance test	**0.03254**	0.01104	0.000171	0.0003328

The stars in the table depict the range of the p-value linked to the significance of the individual coefficients.

- * p-value < 0.1
- ** p-value < 0.05
- *** p-value < 0.01

If no star is indicated, then the p-value is larger than 0.1 and it cannot be concluded that the coefficient is significantly different from 0. The value written in the parentheses is the standard deviation of the coefficients.

According to the model selection methodology described above and based on the details found in Table 1, the model including all variables as well as the intercept, is the most significant regional model obtained and will be studied more closely in this section.

The p-value of the test is smaller than 5% which means the test is significant (LSBA, 2014).

The multiple R-squared gives the amount of variability explained by the model. In this case, the model explains 81.27% of the variability of the dependent variable (the number of local currencies in the region). (LSBA, 2014).

The intercept has a value of 104.104 which means that, if all indicators are set to zero, it is predicted that about 104 local currencies would exist in a fictional region in which all other indicators are set to 0 or 1 for the explanatory variables containing a logarithm. However, this coefficient is not significant so any conclusion of this sort must be drawn with care.

The logarithm of regional population is a significant indicator in this model with a coefficient of 5.406. This implies that the size of the population in a region partially has an influence on the number of local currencies emitted in the area. This shows that local currencies are relatively well distributed amongst regions, depending on their population size.

The significant coefficient for the logarithm of the annual income levels in 2015 is of -24.832. The value of the coefficient is negative. This shows that when income in a region is lower, the number of local currencies emitted in that region will tend to be higher than in a region with higher income levels. Applying a logarithm does not affect the order of the data. This is in line with the hypothesis formulated above.

The logarithm of the average household electricity consumption coefficient (not weather adjusted in this case) has a value of 9.118. The coefficient is positive which means that the higher the average electricity consumption in a region, the larger the number of local currencies. This result goes in the opposite direction than what was expected regarding environmental awareness. This could be linked to the fact that electricity consumption is an imperfect indicator on which more details will be given in the limitations section.

The independence indicator has a value of 2.119 but is not significant. Thus, nothing can be concluded regarding the effect of independence movements on the creation of local currencies.

The coefficient for poverty rate stands at -55.275 and is not significant. No conclusions can be drawn for this indicator.

The percentage of organic agriculture has a coefficient of 31.781. It can be concluded that the coefficient is very close to a significant level with a p-value just slightly over 10%. This level is slightly higher than what is generally accepted at 5% but the significance level was, in this case, somewhat extended due to the small amount of data available for the model although conclusions must then must be drawn with care. This shows that the number of local currencies in a region is positively influenced by the percentage of organic agriculture fields in the same region. This relationship matches the hypothesis whereby environmental awareness increases the incentive to launch a local currency.

Finally, the coefficient attributed to the long term unemployment rate is of -111.106. However, the standard error is very large compared to the coefficient and the p-value is sizeable as well. Thus, no conclusions can be drawn regarding the influence of long term unemployment on the creation of local currencies.

The results of the analysis are summarized in Figure 4.

Regional model			
Hypotheses	Sub-hypotheses	Indicator	Hypothesis verified?
Demographic	Population	Population size	Yes
Social	Wealth	Income per capita	No
		Poverty rate	?
	Social isolation and poverty	Long term unemployment	?
Cultural	Identity	Presence of independence movement	?
	Environmental awareness	Electricity consumption	No
		Organic agriculture	(Yes)

Figure 4: Verification of the hypotheses of the regional model

The initial hypothesis was for each indicator, if it had a higher value, the number of local currencies in the area would grow accordingly, except for income and electricity consumption which were expected to have the opposite effect. As summarized in the table, when testing the contextual factors of the creation of local currencies in French regions, it can be noticed that a more populated region will lead to more local currencies. The identity factor also follows the intuition of the hypothesis, increasing the number of local currencies in a region, but the coefficients was deemed insignificant so this conclusion must be drawn with caution.

Surprisingly, an increased electricity consumption and a reduced poverty rate tend to lead to more local currencies. This goes against what was initially suggested. However, electricity consumption is an imperfect indicator of environmental awareness because household may have other strong incentives to reduce their energy use than their care for the environment. Regarding the poverty rate, some studies show that community currencies are more often

established in cities because there, people tend to have a higher education level (Collom, 2005). The same situation could hold for local currencies and people with lower education tend to be more subject to poverty (Henaff et al., 2009). This could explain why areas with lower poverty rates tend to have an increased number of local currencies. Poorer areas may not have the resources or easy access to the knowledge necessary to establish local currencies even if they could benefit from them.

Finally, nothing can be established with certainty when taking a closer look at long term unemployment rate, independency movements and poverty rate as these indicators were deemed strongly insignificant. In this model, these do not help explain the variability of the dependent variable.

There are four main validity conditions when considering linear regressions: independence of explanatory variables, linearity, normality of residues and homoscedasticity (Pallant, 2013). The aim of this section is to test if the model respects these conditions or if it does not respect the Gauss-Markov theorem and thus does not provide Best Linear Unbiased Estimators.

In order to test the independence of the explanatory variables, the variance inflation factors (VIF), a type of measure used to detect the presence of multicollinearity issues that might not have appeared so clearly in the correlation matrix (Pallant, 2013), were studied for the selected regional model. Details of these VIF are presented in Table 2.

Table 2 *Variance inflation factors of the regional model*

Independent variable	VIF
$Log(X_1)$	3.0996
$Log(X_2)$	1.8859
$Log(X_3)$	1.6982
X_4	9.1137
X_5	1.4790
X_6	3.0091
X_7	7.3740

The variance inflation factor for each coefficient is smaller than 10 which indicates that there are no hints of severe multicollinearity. The presence of multicollinearity indicates issues with the independence of explanatory variables (Falissard, n.d.) but this is not the case with the present model. Also, when looking at the correlation matrix, which is available in the appendix 3.1, there is no correlation between two different indicators which are larger than 0.9 and which would indicate a strong collinearity. (Pallant, 2013).

Another important hypothesis in multiple linear regression is that a linear relationship exists between the errors of prediction the independent variables. The existence of this relationship can be observed through scatterplot of the residuals. The scatterplot should be relatively randomly distributed within a rectangle with a slightly increased concentration in along the center line (Tabachnick & Fidell, 2013, p. 125-127). When looking more closely at the scatterplot shown in Figure 5, this seems to be the case despite the lack of data points.

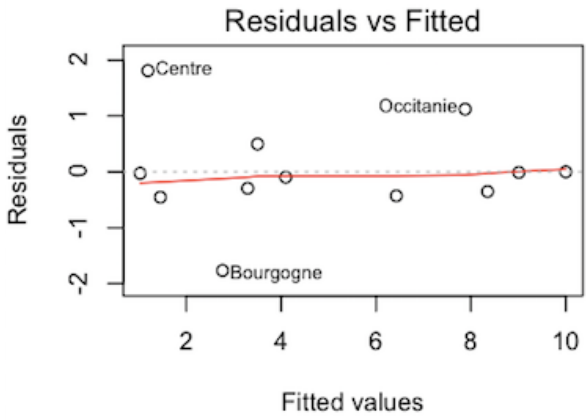


Figure 5: Scatterplot of the residuals in the regional model

In linear regressions, normality is studied through residues (Pallant, 2013). It is possible to observe the normality or non-normality of residuals when analyzing model diagnostic graphs in R. If the values fall along the diagonal line in the Normal Q-Q graph, it indicates the normality of the residues for the tested model (Rodrígez, 2017). When studying the Normal Q-Q graph of the regional model presented in Figure 6, we can observe that the different points are roughly situated along the bisector although it is difficult to conclude with certainty that the residuals follow a normal distribution. Normality of the residues can also be tested visually by observing the histogram of the residues (Falissard, n.d.) presented in Figure 7. From this visual analysis and due to the lack of data, it is difficult to confirm or disprove

further the normality of the errors in the regional model. The model might thus not provide the Best Linear Unbiased Estimators.

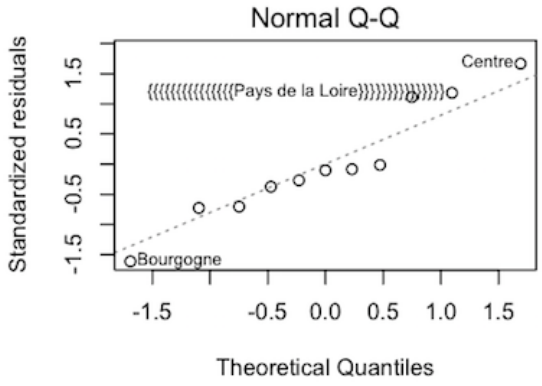


Figure 6: Normal Q-Q graph of the regional model

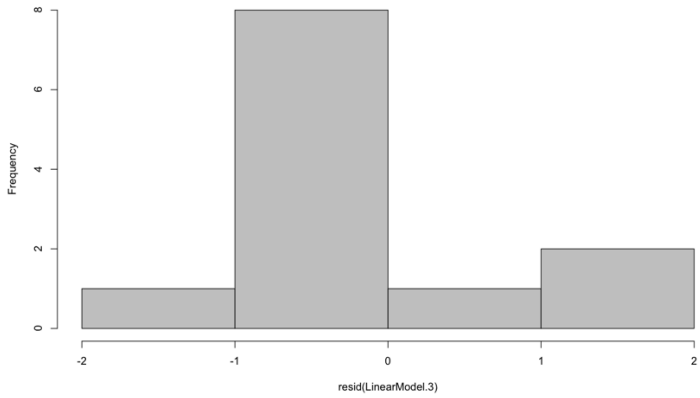


Figure 7: Histogram of the residuals of the regional model

To test if the model satisfies the homoscedasticity condition, the Breusch-Pagan test can be used in which the null hypothesis depicts the presence of homoscedasticity (Breusch & Pagan, 1979). The p-value of the test is of 14.66 %. The null hypothesis, according to which the model is homoscedastic can thus not be rejected. There is no strong sign of the presence of heteroscedasticity.

Finally, it is important to note that an important flaw of the model is its lack of data. According to Tabachnick and Fidell (2013), it is requested that the sample size is of at least 50 + 8m where m is the number of explanatory variables used in the model. The sample size is well below the required 106 observations (the model relies on 7 independent variables).

7.2 Time series model

In this section, the selection of the most significant time series model will be detailed. The data obtained from this model will then be described and studied more closely, in comparison with the hypotheses formulated in the Model and indicators section. Finally, the validity conditions for the most significant model will be examined, such as normality of the residues and multicollinearity, in order to evaluate if the model provides Best Linear Unbiased Estimators which is the aim of a linear regression.

The time series model, including all the factors needed to test the hypotheses for the time series analysis, stands as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \epsilon$$

Where

Y is the expected number of local currencies in a year

X_1 is the annual variation of country deficit

X_2 is the annual inflation rate

X_3 is the annual variation of money (M3) in circulation

X_4 is the annual variation of income per capita

X_5 is the annual poverty rate

X_6 is the annual household and professional electricity consumption in TWh

X_7 is the annual unemployment rate

The βs represent the coefficients allocated to each of the corresponding independent variable and epsilon is the error or residual which represents the distance between the linear regression and the real value of the independent variable.

The model is then run in a statistical program in order to obtain a linear regression including all of the indicators. In order to obtain the most significant model, the different models are run and tested according to the model selection procedure describe earlier in

the model specification section. Each column represents the model examined at each of the different steps of the model selection method, starting with the model including all the variables and then removing each time the least significant variable in order to identify the most significant model.

Table 3 *Coefficient values of the time-series model*

Y: dependent variable

	(1)	(2)	**(3)**	(4)	(5)
Intercept	-154.935 (40.26)	-142.577** (29.643)	**-122.865**** **(26.443)**	-139.26*** (24.86)	-106.57*** (17.99)
X_1	289.967 (146.766)	206.012* (55.044)	**218.385**** **(57.922)**	210.08** (62.16)	125.76** (42.77)
X_2	453.023 (311.836)	263.941* (83.085)	**186.553**** **(56.189)**	189.46** (60.39)	196.67** (69.02)
X_3	89.87 (61.367)	56.737 (27.595)	**51.068** **(29.125)**	48.36 (28.51)	-
X_4	177.721 (155.614)	151.182 (125.877)	-	-	-
X_5	1019.356 (271.47)	1131.868** (173.504)	**1019.535***** **(156.543)**	974.69*** (165.73)	774.03*** (133.02)
X_6	-0.106 (0.084)	-0.0972 (0.0698)	**-0.111** **(0.074)**	-	-
X_7	236.23 (269.439)	-	-	-	-
AIC	33.976	35.061	**37.949**	44.153	46.699
BIC	35.751	36.639	**39.329**	45.968	48.212
Adjusted-R^2	0.8662	0.9059	**0.892**	0.8719	0.8318
P-value of the global significance test	0.2596	0.0689	**0.0267**	0.0045	0.003

Again, the stars in the table depict the range of the p-value linked to the significance of the individual indicator.

- * p-value < 0.1
- ** p-value < 0.05
- *** p-value < 0.01

If no star is indicated, then the p-value is larger than 0.1 and it cannot be concluded that the coefficient is significantly different from 0. The value written in the parentheses is the standard deviation of the coefficients.

As can be deduced from Table 3, the model that obtains the best score when looking at AIC, BIC and adjusted R-squared is the model including all the independent variables. However, the global significance value for the p-value of the F-test on the model is larger than 5% so it cannot be concluded that the test is significant or, in other words, that at least one coefficient, when all tested together, is not significantly different from 0. The model might then not be a relevant one. (Hill et al., 2012). The next best model is then the one excluding only the annual unemployment rate. Unfortunately, the same conclusions emerge when studying the overall significance of the model as with the previous one.

When removing again the least significant variable, annual income variations, the test then becomes significant. This third model is, within the significant model group, the test that has the highest adjusted R-squared as well as the lowest AIC and BIC. That is why it has been selected for further data analysis.

The most significant model which will be studied more closely in this section can be rewritten as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_5 X_5 + \beta_6 X_6 + \epsilon$$

It has a p-value of 2,67% which is smaller than 5% and reveals a global significance of the model. We also notice that two observations were removed. They relate to the data from the year 2017 which has not yet been published as well as the electricity data from 2007 as records on weather-adjusted electricity are not available that far back.

The first coefficient to appear in the list is the intercept which has a value of -122,87. It is relevant with a p-value of less than 2%. It may seem strange to have a negative value for the

number of local currency projects established in a year. When looking at the other indicators, we notice that most of them have a strong positive coefficient however as some of these represent a yearly variation, if they are smaller than zero, the risk is to end up with a negative value for the number of local currencies created in a year. However, the cases in which inflation, deficit and money aggregate evolution are negative, are rare. Also, poverty rate will never go below zero. The subject of negative intercepts when running a linear regression and where a negative dependent variable is inconceivable, is quite controversial. The suggested alternative is to remove the intercept from the model and verify if the model becomes more relevant by doing so. This is then called a regression through origin (RTO) (Eisenhauer, 2003). The details of the model without the intercept can be found in appendix 3.2.1. The overall model has a p-value larger than 5% and none of the indicators have a significant coefficient. The adjusted r-squared is a lot smaller in the RTO model and the AIC and BIC are much larger. It then seems more relevant to include the intercept in the model even though it is negative and does not have much of a relevant stand-alone interpretation than to remove it and obtain an insignificant model. It must also be noted that the other coefficients tend to compensate for the negativity of the intercept and that predictive models should not be considered when the data tested is very far-off from the data on which the model was initially built. It is possible that the linearity only exists within the observed data range (Hocking, 1996, p.177). More details on the issues linked to using a linear regression will be given in the limitations section.

The variation of the deficit has a positive impact of 218,38 on the creation of local currencies. This coefficient is significant. This means that when the country debt increases, the number of local currencies created increases as well. A strong increase in deficit is often linked to a recession period (Kondonassis, 2013). This indicator is consistent with the hypothesis presented earlier.

Regarding the electricity component, the coefficient is not significant with a p-value larger than 5%. No interpretation of this indicator can thus be established.

Inflation is the following relevant indicator with a coefficient of 186,55. The indicator is here used to partially measure the impact of lack of liquidities in the economic environment. A strong inflation, according to the coefficient, leads to an increased number of local currency projects. However, when looking at the time period in which the data was collected, we notice that inflation is relatively weak throughout. The extended hypothesis according to which

hyperinflation leads to the creation of local currencies can thus not be verified with the situation and the data used to test the model.

The coefficient for the M3 money aggregate has a positive value of 51,07. However, the coefficient is not significant with a p-value of 17,78%.

Poverty rate has a relevant positive impact on the creation of local currencies. With a coefficient of 1019,53 and an indicator mean of 13,41% with a minimum of 12,5%, it balances out, in all years presented in the data, the negative value of the intercept. An increase in poverty rate leads to an increase in the number of local currencies created. This indicator is in line with the hypothesis formulated initially.

Finally, annual unemployment rate was considered insignificant and no conclusions can be drawn regarding this parameter.

The results of the analysis are summarized in the Figure 8.

Time-series model			
Hypotheses	Sub-hypotheses	Indicator	Hypothesis verified?
Economic	Economic crisis	Country debt	Yes
		Unemployment rate	?
	Lack of liquidities	Money in circulation	?
		Inflation	Yes
Social	Wealth	Income per capita	?
	Social isolation and poverty	Poverty rate	Yes
Cultural	Environmental awareness	Electricity consumption	?

Figure 8: Verification of the hypotheses of the time-series model

There are four main validity conditions when considering linear regressions: independence of explanatory variables, linearity, normality of residues and homoscedasticity. The aim of this section is to test if the model respects these conditions or if it does not respect the Gauss-Markov theorem and thus does not provide Best Linear Unbiased Estimators.

In order to test the independence of the explanatory variables, the variance inflation factors (VIF), a type of measure used to detect the presence of multicollinearity issues that might not have appeared so clearly in the correlation matrix (Pallant, 2013), were studied for the selected time-series model. Details of these VIF are presented in Table 4.

Table 4 *Variance inflation factors of the time-series*

Independent variable	VIF
X_1	2.2659
X_2	1.0160
X_3	3.1633
X_5	2.0301
X_6	1.1850

The variance inflation factor for each coefficient is smaller than 10 which indicates that there are no hints of severe multicollinearity. The presence of multicollinearity indicates issues with the independence of explanatory variables (Falissard, n.d.) but this is not the case with the present model. Also, when looking at the correlation matrix, which is available in the appendix 3.2.2, there is no correlation between two different indicators which are larger than 0.9 and which would indicate a strong collinearity (Pallant, 2013).

Another important hypothesis in multiple linear regression is that a linear relationship exists between the errors of prediction the independent variables. The existence of this relationship can be observed through scatterplot of the residuals. The scatterplot should be relatively randomly distributed within a rectangle with a slightly increased concentration in along the center line When looking more closely at the scatterplot shown in Figure 9, the points seem

relatively randomly distributed or at least, there are no clear curve patterns in their distribution which would be a strong sign of non-linearity. (Tabachnick & Fidell, 2013, p.125-127).

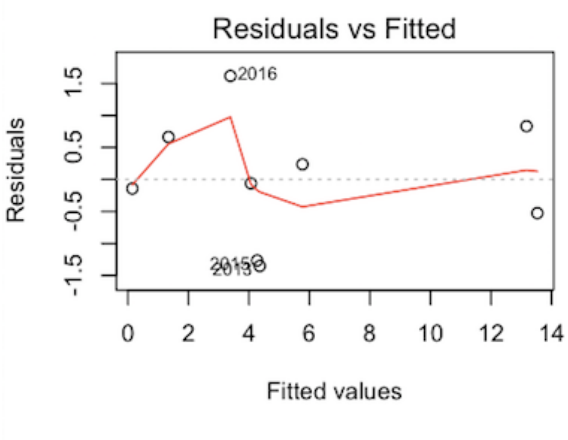


Figure 9: Scatterplot of the residuals of the time-series model

In linear regressions, normality is studied through residues (Pallant, 2013). It is possible to observe the normality or non-normality of residuals when analyzing model diagnostic graphs in R. If the values fall along the diagonal line in the Normal Q-Q graph, it indicates the normality of the residues for the tested model (Rodrígez, 2017). When studying the Normal Q-Q graph of the time-series model presented in Figure 10, we can observe that the different points are roughly situated along the bisector.

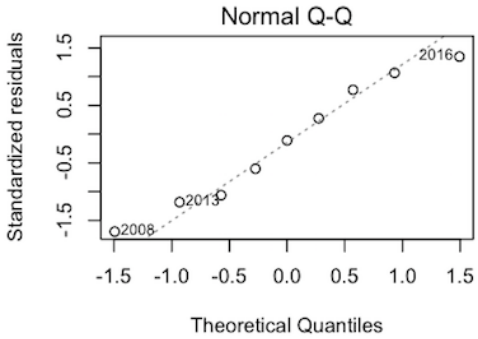


Figure 10: Normal Q-Q graph of the time-series model

To test if the model satisfies the homoscedasticity condition, the Breusch-Pagan test can be used in which the null hypothesis depicts the presence of homoscedasticity (Breusch & Pagan, 1979). The p-value of the test is of 77.95 %. The null hypothesis, according to which the model is homoscedastic can thus not be rejected. There is no strong sign of the presence of heteroscedasticity.

Finally, it is important to note that an important flaw of the model is its lack of data. According to Tabachnick and Fidell (2013), it is requested that the sample size is of at least 50 + 8m where m is the number of explanatory variables used in the model. Due to a lack of historical data on local currencies, the number of observations is limited to just 10 years which is largely insufficient compared to the recommended sample size of 90 (the selected model has 5 independent variables).

8. Limitations

The main issue with the data analysis is the lack of data input into the model testing. This comes from the difficulty to collect data on a phenomenon which is, by definition, isolated and organized by relatively independent groups. It would be interesting to run the same model with data from several countries or on a longer period of time. It could also be interesting to include data from community currencies such as LETS as they are close to local currency systems, in order to obtain more data and expand the time frame. This would allow for more significant data analysis.

Despite this lack of observations, the distribution of the data in both models seem relatively in line with the validity conditions for both models. However, to create a more general, reliable and stable model, and to verify these conditions with more certainty, a much larger database would be required.

Regarding the data, two other limitations have been pointed out. Firstly, there is no certainty that the MLCC network regroups all of the current local currency throughout France. Some more independent or marginal organizations could operate outside of the network. The data used to construct the model could thus be incomplete. Secondly, the choice to include local currencies that had been abandoned has been explained. However, abandoned currencies must be considered with care as it could be the sign of a changing context which suppresses the need for smaller-scale means of payment. This could result in misleading models but as the number of abandoned currencies is quite small compared to the total number of currencies, the effect, in this case, should be marginal. Additionally, the timespan of the data is relatively short so the changes in contextual factors should be somewhat limited. It could be interesting to include discarded local currencies exclusively in the time series model but remove them from the regional model if the data were to cover a larger time horizon.

Also, making use of a linear regression to study the relationship between the number of local currencies and the dependent variables leads to some uncertainties or disadvantages. First of all, both models aim at depicting a natural number, the number of local currencies created in a year or in a region, but, through a linear regression, this number will be represented as a continuous variable. Logistic regressions are available for dichotomous variables but this is an even less appropriate type of model for the situation studied in this thesis. An important limit with the use of a linear regression is that it underlines the relationship between the

independent and dependent variables but does not necessarily indicate a causal relationship. Thus, any explanation or conclusion drawn from the data analysis must be considered with care. (Jeon, 2015). The lack of data intensifies this issue in both of the presented models.

As already discussed in the data analysis section of the time series model, it is important to note that the conclusions drawn from both analyses are only valid within the observed data range and linearity conditions are only observed within this range. It is thus important not to extrapolate the findings of this thesis to a country or a time period with characteristics very different from those of France between 2007 and 2017.

Another issue with the presented models is that potential interactions between variables were overlooked. For example, poorer household tend to be more subject to unemployment and use less energy than richer ones. It could be interesting to test a model including relevant interactions and compare it with the models developed in this thesis. It would be even more noteworthy to do so with more available data which would then lead to more significant results. However, including interaction effects prevents the analysis of the stand-alone parameters and that is why they have not been included in the presented models.

In the regional model it might be more significant to stop the counter of local currencies at a certain year in the past and use the data from that specific year for the different independent variables if available.

An alternative is also to test the creation of local currency projects against the value of the different indicators from the previous year. This allows to take into account a certain lead time between the moment when participants started thinking about the project and the moment it was officially launched.

Finally, with a much larger quantity of data, a regional time-series analysis model could be relevant due to the important differences in the number of local currencies as well as in the different indicators between region.

When looking more specifically into some of the indicators within the model, we notice that some modifications or improvements could be interesting to implement.

First of all, in the regional and time series model, there was no available data regarding weather adjusted consumption of households. This implies that climate differences between

regions in the regional model and yearly climate variations in the time-series model, were taken into account in the model to measure environmental awareness. Using weather-adjusted values allows to subtract fluctuations due to weather conditions and thus levelling out annual and regional weather variations. This weather-adjusted measure helps to focus on the electricity individuals more or less choose to use for other purposes than heating their home. It would be a lot more interesting and relevant for the model if the data excluded climate differences and assumed that regions and years with a harsher weather automatically consumed more electricity.

Two important factors that could influence the number of local currencies in a region or in a year were not included in the model because these are difficult to evaluate with the observed time frame and challenging to include in a linear regression model.

First of all, the presence of a war, which often regroups a variety of issues described above, such as lack of liquidities, poverty, a need for a faster circulation of money or a way to maintain some form of local economy, could be an interesting factor to include in the analysis. Historical examples show that in the event of a war, local currencies are created to try to solve some of the problems raised. As there was no war in the studied area during the studied time period, this factor could not be included in the model but it would be interesting to test this element in a larger model including other countries and with a larger timeframe.

Finally, an indicator difficult to capture through a linear regression is the trend or fashion effect created by the creation of local currencies in a region. In other words, when a town or city launches a new local currency, the idea is more likely to spread throughout the area as it gives visibility to the project and demonstrates in a more practical way the uses and advantages of local money to neighboring towns, cities or regions.

9. Conclusion

In the scientific literature, community currencies have been a much more studied topic than local currencies which have only recently regained a stronger interest. The studies that have been led on alternative currencies focused more on the people participating in these programs or on their impacts. However, no research analyzed why local currencies come and go and which factors influence the growth of the phenomenon.

Based on the literature, historical and present-day examples, the purpose of this thesis has been to shed some light on the macro-factors affecting the growth process of local currency projects both on a yearly basis and on a regional basis. These factors, through chosen indicators, were tested using French data from 2007 until 2017 through a multiple linear regression model. The different indicators were aimed at depicting economic, social and cultural hypotheses.

In the regional model, it was discovered that a larger population size and a higher percentage of organic agriculture tended to increase the number of local currencies both of which confirmed what had been established in theory. On the other hand, from the literature and from real-life examples, it was deduced that lower income and lower electricity consumption would lead to a larger number of local monies whilst, according to French data, they seem to have the opposite effect. This may be linked with higher education levels as well as a higher energy consumption, due to increased means, in richer areas. The other indicators were deemed insignificant in this model so nothing can be concluded on their regard.

In the time-series model, three indicators out of the seven appeared to be significant. These were country debt, inflation and poverty rate which all confirmed what had been established based on the literature and on existing local currency projects.

It is difficult to compare the two models because they do not have coinciding significant indicators. However, one parallel can be made when looking at societal indicators when looking at both models. According to the regional model, areas with higher income have more local currencies whilst the national model demonstrates that local currencies gain more interest when poverty rate increases. This could indicate that, when the overall economic health of citizens declines, richer regions are more prone to finding solutions to the downturn.

Further studying the topic of factors influencing the creation of local currencies would allow to identify measurable indicators which signal a favorable context or even a need for the development of local currency projects in certain regions or at a certain point in time. It also helps to get a better understanding of the reasons behind this current trendy phenomenon which, due to its relative marginality and independence, is not always well documented or understood.

In future studies it would be very interesting to extend the database either on a time- or geographical-basis. To generalize the conclusion of the study, it is necessary to test the model on the data coming from other countries as well as extended time periods. This would allow to pinpoint the existence of similar trends throughout history which would underline a repeated favorable context for the emergence of local currencies.

Finally, the bigger question with local currencies is to what extent they have the ability to influence and participate in solving the societal issues the world is facing today. This, however, is out of the scope of this thesis and can be looked at in further studies.

References

Aglietta, M., Ould-Ahmed, P., & Ponsot, J. (2016). *La monnaie: Entre dettes et souveraineté.* Paris, France: Odile Jacob.

Alavoine-Mornas, F., & Madelrieux, S. (2014). Passages à l'agriculture biologique. *Economie Rurale, 339-340*(1), 65-79.

Banque WIR société cooperative. (no date). *Histoire/charte d'entreprise.* Retrieved January 21, 2018 from https://www.wir.ch/fr/qui-est-wir/histoire-charte-dentreprise/

Blanc, J. (2000). *Les monnaies parallèles, unité et diversité du fait monétaire.* Paris, France: L'Harmattan.

Blanc, J. (2006, September). Local currencies in european history: An analyticial framework. Paper presented at Monetary regionalisation. Local currency systems as catalysts for endogenous regional development, International Scientific Conference, Weimar, Germany.

Blanc, J. (Ed.), & Centre Auguste et Léon Walras. (2006). *Exclusion et liens financiers: Monnaies sociales.* Paris: Economica.

Blanc, J. (2011). Classifying "CCs": Community, complementary and local currencies' types and generations. *International Journal of Community Currency Research, 15*, 4-10.

Bodislav, A. (2012). How did we get to the deficit spectrum of the economic crisis? *Romanian Journal of Fiscal Policy, 3*(1), 9-19.

Breusch, T. S., & Pagan, A. R. (1979). A simple test for heteroscedasticity and random coefficient variation. *Econometrica, 47*(5), 1287-1294.

Burda, M. & Wyplosz, C. (2009). *Macroeconomics, A European text.* New York, United States of America: Oxford University Press Inc.

Charrel, M. (2018, April 5). Paris aura bientôt sa propre monnaie locale. *Le Monde Economie.* Retrieved April 21, 2018 from http://www.lemonde.fr/economie/article/2018/04/05/paris-aura-bientot-sa-propre-monnaie-locale_5281019_3234.html?xtmc=monnaie_locale&xtcr=6

Cohen, B. (2016). The rise of alternative currencies in Post-Capitalism. *Journal of Management Studies, 54*(5), 739-746. doi:10.111/joms.12245

Collom, E. (2005). Community currency in the United States: The social environments in which it emerges and survives. *Environment and Planning A, 37*(9), 1565-1587.

Coomer, J., & Gstraunthaler T. (2011). The hyperinflation in Zimbabwe. *Quarterly Journal of Austrian Economics, 14*(3), 311-346.

Daniel, J-M. (2010, September 27). Silvio Gesell, inventeur de la "monnaie fondante". *Le Monde Economie.* Retrieved December 27, 2017 from http://www.lemonde.fr/idees/article/2010/09/27/silvio-gesell-inventeur-de-la-monnaie-fondante_1416404_3232.html

Eisenhauer, J. G. (2003). Regression through the origin. *Teaching Statistics, 25*(3), 76-80. doi: 10.1111/1467-9639.00136

Eutcheleku, P. (2017, January 30). La monnaie locale basque eusko se dématérialise. *Les Echos.*

Falissard, B. (no date). Régression linéaire multiple (ANCOVA) et ANOVA I [video]. Retrieved from http://sites.uclouvain.be/selt/ressources/396173

Fare, M., & Ahmed, P. O. (2017). Complementary currency systems and their ability to support economic and social changes. *Development and Change, 48*(5), 846-872. doi:10.1111/dech.12322

Fare, M., & Ahmed, P. O. (2018). Why are Complementary Currency Systems Difficult to Grasp within Conventional Economics?. *Revue interventions économics, 59.*

Financial Times. (no date a). *Definition of M0, M1, M2, M3, M4.* Retrieved December 11, 2017, from http://lexicon.ft.com/Term?term=M0,-M1,-M2,-M3,-M4

Financial Times. (no date b). *Definition of velocity of circulation.* Retrieved January 20, 2018, from http://lexicon.ft.com/Term?term=velocity-of-circulation

Fourel, C., Magnen, J., & Meunier, N. (2015). *D'autres monnaies pour une nouvelle prospérité.* Lormont, France: Le bord de l'eau.

Guyomart, J. (2013) De l'état-souverain à la souveraineté subsidiaire des monnaies locales complémentaires. *Revue Française De Socio-Economie, n12*(2), 51-68.

Granger, R. C., Wringe, J., & Andrews, P. (2010). LETS as alternative, post-capitalist economic spaces? Learning lessons from the Totnes 'Acorn'. *Local Economy: The Journal of the Local Economy Policy Unit, 25*(7), 573-585.

Henaff, N., Lange, M., & Martin, J. (2009) Revisiting the link between poverty and education. *Revue Française De Socio-Economie, 3*(1), 187-194. doi:10.3917/rfse.003.0187

Hill, C. R., Griffiths, W. E., & Lim, G. C. (2012). *Principles of econometrics* (4th, international student version ed.). Hoboken (N. J.), USA: Wiley.

Hocking, R.R. (1996). *Methods and Applications of Linear Models: Regression and Analysis of Variance.* New York, USA: John Wiley.

Jeon, J. (2015). The strengths and limitations of the statistical modeling of complex social phenomenon: Focusing on SEM, Path Analysis, or Multiple Regression Models. *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering 9*(5), 1634-1642.

Kemp-Robertson, P. (2013, June). Bitcoin. Sweat. Tide. Meet the future of branded currency. Communication presented at TedGlobal 2013. Retrieved November 9, 2017, from https://www.ted.com/talks/paul_kemp_robertson_bitcoin_sweat_tide_meet_the_future_of_branded_currency

Khan Academy. (no date). *Circular flow of income.* Retrieved January 20, 2018, from https://www.khanacademy.org/economics-finance-domain/macroeconomics/gdp-topic/circular-econ-gdp-tutorial/v/circular-flow-of-income-and-expenditures

Kim, S. M., Lough, B., & Wu, C. (2016). The conditions and strategies for success of local currency movements. *Local Economy: The Journal of the Local Economy Policy Unit, 31*(3), 344-358. doi:10.1177/0269094216637332

Kondonassis, A. J. (2013). Recessions, budget deficits, and austerity: A comment on the US and European economies. *Journal of Applied Business Research, 29*(1), 1-6.

Larue, L. (2017a, May). A general and neutral framework for classifying currencies. Paper presented at the 4th International Conference on social and complementary currencies, Barcelona, Spain.

Larue, L. (2017b). Quel crédit donner aux monnaies alternatives?. *La Revue Nouvelle, 72*(6).

Le réseau des MLCC. (2013, June 21). *Adhérer au réseau des MLCC – Signer le Manifeste et la Charte.* Retrieved January 31, 2018, from http://monnaie-locale-complementaire-citoyenne.net/adhesion-mlcc/

Le réseau des MLCC. (no date a). *Histoire du réseau des MLCC.* Retrieved February 18, 2018, from http://monnaie-locale-complementaire-citoyenne.net/histoire-du-reseau-des-mlcc/

Le réseau des MLCC. (no date b). *Les monnaies locales en France.* Retrieved January 21, 2018, from http://monnaie-locale-complementaire-citoyenne.net/france/

Les monnaies locales complémentaires [Video]. (2014). France: Arte Futurmag. Retrieved Febuary 3, 2018 from https://www.youtube.com/watch?v=mpE8UMMZa9w

Le talent. (no date). *Le talent, La monnoie locale citoyenne du centre du Brabant wallon.* Retrieved February 13, 2018 from http://letalent.be/index.php/le-talent/

Levinson, D. (2014, June 23). What gives a dollar bill its value? [Video]. *TED-Ed.* Retrieved January 17, 2018 from https://www.youtube.com/watch?v=XNu5ppFZbHo

Lietaer, B. (2001). *The future of money: A new way to create wealth, work and a wiser world.* London, UK: Century.

Lietaer, B. (2009). Créer des monnaies regionales pour traiter la crise globale. *Le Journal De l'Ecole De Paris Du Management, 80*(6), 8-15. doi: 10.3917/jepam.080.0008

LSBA (2014, April 1). Rcmdr: Régression linéaire multiple: validation et selection de modèles [Video]. Retrieved February 16, 2018 from http://sites.uclouvain.be/selt/ressources/199413

Marie, J. (2014). Hyperinflation argentine de 1989: Une interprétation post-keynésienne. *Revue de la régulation, 15*(1st semester). doi: 10.4000/regulation.10794

Michel, A., & Hudon, M. (2015). Community currencies and sustainable development: A systematic review. *Ecological Economics, 116,* 160-171. doi: 10.1016/j.ecolecon.2015.04.023

Money. (May 10, 2018). In *Merriam-Webster Online.* Retrieved May 22, 2018, from https://www.merriam-webster.com/dictionary/money

Mukher, S. (no date). Money market Equilibrium in an Economy. *Economic Discussion.* Retrieved April 12, 2018 from http://www.economicsdiscussion.net/money/money-market-equilibrium/money-market-equilibrium-in-an-economy-with-problems/10500

OECD. (2018). *Monnaie au sens large (M3) (indicateur).* doi: 10.1787/1d34b815-fr. Retrieved February 13, 2018, from https://data.oecd.org/fr/money/monnaie-au-sens-large-m3.htm

Pallant, J. (2013). *SPSS Survival Manual: A step by step guide to data analysis using IBM SPSS* (5th Edition). Maidenhead, UK: McGraw-Hill.

Peacock, M. S. (2014). Complementary currencies: History, theory, prospects. *Local Economy: The Journal of the Local Economy Policy Unit, 29(*6-7), 708-722. doi:10.1177/0269094214553174

Privat, H. (2014). *Etude des motivations au sélisme: Dimensionnement, antécédents et influence sur la pratique séliste* (Docteral dissertation). Université de Bretagne occidentale, Brest, France. Retrieved from https://uclouvain-summon-serialssolutions-com.proxy.bib.ucl.ac.be:2443/#!/search?bookMark=ePnHCXMw42LgTQStzc4rAe_hSuFkyDzcCTqmUSEltVghF35pV7FCYqlC8eGVOZnFuakKVgopoMPsQQNEeeBhMR0FoMGHVyYfXgnar1qskFqikAm7tUOhuLRIISdRoQAURsDSE2oMaPsNSx6w48bNIO_mGuLsoZuYlFocD3RLMZACVnQmTkBPgToAxoRVAADfNUW1

Riboud, J. (1980). *The mechanics of money* (S. Harrison, Trans.). London, UK: The MacMillan Press LTD.

Rittenberg, L., & Tregarthen, T. (2009). *Macroeconomics Principles (Version 2.0)*. Boston, USA: Flat World Knowledge, Inc.

Rodrídrigez, G. (2017). Generalized linear models. Retrieved April 16, 2018, from http://data.princeton.edu/wws509/notes/c2s9.html

Rogers, J. (2013, June 17). Bristol pound is just one example of what local currencies can achieve. *The Guardian.* Retrieved December 11, 2017, from https://www.theguardian.com/local-government-network/2013/jun/17/bristol-pound-local-currencies

Saiag, H. (2014). Le trueque argentin ou la question du fédéralisme monétaire (1995-2002). *Revue Française De Socio-Economie, n* 12(2), 69-89.

Seyfang, G. (2003). Growing cohesive communities one favour at a time : Social exclusion, active citizenship and time banks. *International Journal of Urban and Regional Research, 27*(3), 699-706. doi :10.1111/1468-2427.00475

Sub-national currencies: local difficulties. (2017, January 7). *The economist.* p. 56

Stodder, J., & Lietaer, B. (2016). The macro-stability of Swiss WIR-bank credits: Balance, velocity and leverage. *Comparative Economic Studies, 58*(4), 570. doi:10.1057/s41294-0160001-5

Tabachnick, B. G., & Fidell, L.S. (2013). *Using multivariate statistics.* (6th edition). Boston, USA: Pearson Education.

Tee, H., & Ong, H. (2016). Cashless payment and economic growth. *Financial Innovation, 2*(1), 1-9. doi: 10.1186/s40854-016-0023-z.

The R foundation. (no date). *What is R?*. Retrieved February 17, 2018 from https://www.r-project.org/about.html

Transition Network. (2016). *About the movement.* Retrieved February 18, 2018 from https://transitionnetwork.org/about-the-movement/

Williams, C. C. (1996). The new barter economy: An appraisal of local exchange and trading systems (LETS). *Journal of Public Policy, 16*(1), 85-101. doi:10.1017/S0143814X0000787X

Wooldridge, J. M. (2009) *Introductory econometrics: a modern approach (4th edition)*. Mason, USA: South-Western Cengage Learning.

Xiong, W., Fu, H., & Wang, Y. (2017). Money creation and circulation in a credit economy. *Physica A: Statistical Mechanics and its Applications, 465,* 425-437. doi:10.1016/j.physa.2016.08.02

Appendixes

Table of Contents

1. Regional data

1.1 Regions

Current Regions (since 2016)	Former Regions (until 2015)
Auvergne-Rhône-Alpes	Auvergne Rhône-Alpes
Bourgogne-Franche-Comté	Bourgogne Franche-Comté
Bretagne	Bretagne
Centre-Val de Loire	Centre
Corse	Corse
Grand Est	Alsace Champagne-Ardenne Lorraine
Hauts-de-France	Nord-Pas-de-Calais Picardie
Ile-de-France	Ile-de-France
Normandie	Basse-Normandie Haute-Normandie
Nouvelle-Aquitaine	Aquitaine Limousin Poitou-Charentes
Occitanie	Languedoc-Roussillon Midi-Pyrénées
Pays de la Loire	Pays de la Loire
Provence-Alpes-Côte d'Azur	Provence-Alpes-Côte d'Azur
Total 13	22

Source:

Régions de France. (2017, September). *Les chiffres clés des Régions.* Retrieved January 22 from http://regions-france.org/chiffres-cles-des-regions/

1.2 Currencies

Region	Number of local currencies launched	Name of local currency project
Auvergne-Rhône-Alpes	9	Canut Commune Doume Elef Gonette Lien Luciole Mesure Sol Alpin
Bourgogne-Franche-Comté	1	Pive
Bretagne	6	Buzuk Galais Galléco Heol Maillette Sardine
Centre-Val de Loire	3	Gabare Lignières Méreau
Corse	0	
Grand Est	4	Déodat Florain Radis Stück
Hauts-de-France	1	Bou'sol
Ile-de-France	1	Pêche
Normandie	3	Agnel Grain Vire
Nouvelle-Aquitaine	10	Abeille Beunéze Eureu Gascon Eusko Lou Pelou Miel pôle Mige Ostrea Tinda Trèfle

Occitanie	9	Céou Cep Cers Montauban Pyrène Sol si Sol-violette Sonnante Touselle
Pays de la Loire	4	Muse Retz'L Rozo Vendéo
Provence-Alpes-Côte d'Azur	8	Cigalonde Roue Roue Aix Roue arlésienne Roue salonais Roue Seve 04 Roue Seve 13 Sud Buëch
Total	59	
Mean	4.54	
Median	4	

Source:

Monnaies Locales Complémentaires Citoyennes. (no date). *Les monnaies locales en France.* Retrieved January 22, 2018 from http://monnaie-locale-complementaire-citoyenne.net/france/

1.3 Population

Region	Regional population 2016
Auvergne-Rhône-Alpes	7940652
Bourgogne-Franche-Comté	2820150
Bretagne	3310341
Centre-Val de Loire	2587004
Corse	330354
Grand Est	5558304
Hauts-de-France	6030309
Ile-de-France	12142802
Normandie	3343247
Nouvelle-Aquitaine	5943096
Occitanie	5830166
Pays de la Loire	3632614
Provence-Alpes-Côte d'Azur	5024192
Total	64493231
Mean	4961018
Median	5024192

Source:

Institut national de la statistique et des études économiques. (no date). *Estimation de population, 2016.* Retrieved January 22, 2018 from https://statistiques-locales.insee.fr/#bbox=-865631,6661347,2223383,1619645&c=indicator&i=filosofi.tp60&s=2014&view=map3

1.4 Long term unemployment

Region	Long term unemployment 2016
Auvergne-Rhône-Alpes	3.17%
Bourgogne-Franche-Comté	3.79%
Bretagne	3.20%
Centre-Val de Loire	4.40%
Corse	-
Grand Est	5.22%
Hauts-de-France	6.31%
Ile-de-France	4.30%
Normandie	4.93%
Nouvelle-Aquitaine	3.94%
Occitanie	4.50%
Pays de la Loire	3.30%
Provence-Alpes-Côte d'Azur	4.60%
Mean	4.30%
Median	4.35%

Source:

Eurostat. (no date). *Regional long-term unemployment rate.* Retrieved January 22, 2018 from http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfst_r_lfu2ltu&lang=en

1.5 Income

Region	Average Disposable Household Income 2015
Auvergne-Rhône-Alpes	18534.60
Bourgogne-Franche-Comté	18074.63
Bretagne	17700
Centre-Val de Loire	18200
Corse	16400
Grand Est	17406.47
Hauts-de-France	16113.82
Ile-de-France	21600
Normandie	17744.30
Nouvelle-Aquitaine	17641.39
Occitanie	17075.43
Pays de la Loire	17600
Provence-Alpes-Côte d'Azur	18100
Mean	17860.82
Median	17700

Source:

Eurostat. (no date). *Disposable income of private households by NUTS 3 regions.* Retrieved January 22, 2018 from http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tgs00026&plugin=1

1.6 Poverty rate

Region	Poverty Rate 2014
Auvergne-Rhône-Alpes	12.70%
Bourgogne-Franche-Comté	13.10%
Bretagne	10.80%
Centre-Val de Loire	12.90%
Corse	20.30%
Grand Est	14.20%
Hauts-de-France	18.30%
Ile-de-France	15.60%
Normandie	13.60%
Nouvelle-Aquitaine	13.60%
Occitanie	17.20%
Pays de la Loire	11.10%
Provence-Alpes-Côte d'Azur	17.50%
Mean	14.68%
Median	13.60%

Source:

Institut national de la statistique et des études économiques. (no date). *Taux de pauvreté (%) 2014.* Retrieved January 22, 2018 from https://statistiques-locales.insee.fr/#c=indicator&i=filosofi.tp60&s=2014&view=map3

1.7 Organic agriculture

Region	Percentage of Organic agriculture (relative to useful agricultural area) 2016
Auvergne-Rhône-Alpes	7.20%
Bourgogne-Franche-Comté	5.20%
Bretagne	5.40%
Centre-Val de Loire	2.30%
Corse	7.20%
Grand Est	3.90%
Hauts-de-France	1.20%
Ile-de-France	2.40%
Normandie	3.90%
Nouvelle-Aquitaine	4.80%
Occitanie	11.50%
Pays de la Loire	7.20%
Provence-Alpes-Côte d'Azur	19.70%
Mean	6.30%
Median	5.20%

Source:

Agence Bio. (2017). *La bio dans les territoires, fiches régionales et de production.* Retrieved January 22, 2018 from http://www.agencebio.org/sites/default/files/upload/documents/4_Chiffres/fiches_regionales_filieres_production.pdf

1.8 Independence

Region	Presence of nationalist movement with official representation 2017
Auvergne-Rhône-Alpes	No
Bourgogne-Franche-Comté	No
Bretagne	No
Centre-Val de Loire	No
Corse	Yes
Grand Est	No
Hauts-de-France	No
Ile-de-France	No
Normandie	No
Nouvelle-Aquitaine	Yes
Occitanie	No
Pays de la Loire	No
Provence-Alpes-Côte d'Azur	No
Total	2

Source:

Renard, C. (June 19, 2017). Mouvements autonomistes: la carte des velléités en Europe. *France Culture.* Retrieved January 22, 2018 from https://www.franceculture.fr/geopolitique/mouvements-autonomistes-la-carte-des-velleites-en-europe

1.9 Electricity

Region	Household electricity consumption per inhabitant 2016 (MWh)
Auvergne-Rhône-Alpes	2488.71
Bourgogne-Franche-Comté	2564.05
Bretagne	2645.95
Centre-Val de Loire	2724.00
Corse	3172.35
Grand Est	2384.36
Hauts-de-France	2216.97
Ile-de-France	1977.63
Normandie	2895.39
Nouvelle-Aquitaine	2878.13
Occitanie	2807.81
Pays de la Loire	1731.85
Provence-Alpes-Côte d'Azur	2932.21
Mean	2570.72
Median	2645.95

Source:

Réseau de transport d'électricité. (no date). *Statistiques de l'énergie électrique en France.* Retrieved January 23, 2018 from https://www.rte-france.com/fr/article/statistiques-de-l-energie-electrique-en-france

2. Time series data

2.1 Currencies

Year	Number of local currencies emitted	Number of successful local currency projects launched
2007	0	1
2008	1	0
2009	0	4
2010	2	6
2011	5	13
2012	4	14
2013	8	3
2014	9	2
2015	12	3
2016	10	5
2017	8	1
Total	59	52
Mean	5.36	4.73
Median	5	3

Sources:

Monnaies Locales Complémentaires Citoyennes. (no date). *Les monnaies locales en France.* Retrieved January 22, 2018 from http://monnaie-locale-complementaire-citoyenne.net/france/

Le Florain – MLCC à Nancy. (October 9, 2017). Notre monnaie locale, le Florain est en circulation! [Video]. Retrieved January 22, 2018 from https://vimeo.com/237366914

Lantrin, J. (no date). *Près de 270 consommateurs!*. Retrieved January 22, 2018 from http://www.monnaie-locale-ploermel.org/wp-content/uploads/2016/08/ArticlePlo.png

Le Rozo, Monnaie locale complémentaire. (no date). *Accueil.* Retrieved January 22, 2018 from http://lerozo.org/category/actualites/page/4/ (Rozo)

Le Retz'l. (no date). *Qui sommes-nous?*. Retrieved January 22, 2018 from http://reseauduretzl.org/qui-sommes-nous/

Association pour une Monnaie Locale Complémentaire Citoyenne en Vendée. (no date). *Les statuts de l'Association.* Retrieved January 22, 2018 from http://www.mlcc85.org/association/statuts.php

La Gabare. (no date). *Calendrier des prochains évènements.* Retrieved January 22, 2018 from http://gabare.mlc.camp/calendrier-des-prochains-evenements/

Le Méreau, la Monnaie Locale Complémentaire du Montargois. (no date). *Agenda.* Retrieved January 22, 2018 from https://mereaudugatinais.blog4ever.com/articles/agenda

La Pive. (no date). *Actualités.* Retrieved January 22, 2018 from https://www.pive.fr/actualites-2/page/3/

Beunèze. (no date). *Actu-Beunèze.* Retrieved January 22, 2018 https://monnaiebeuneze.wordpress.com/actu-beuneze/

Lou Pélou, Monnaie Locale Complémentaire. (May 18, 2013). *Le manifeste.* Retrieved January 22, 2018 from http://lecheminlimousin.org/le-manifeste/

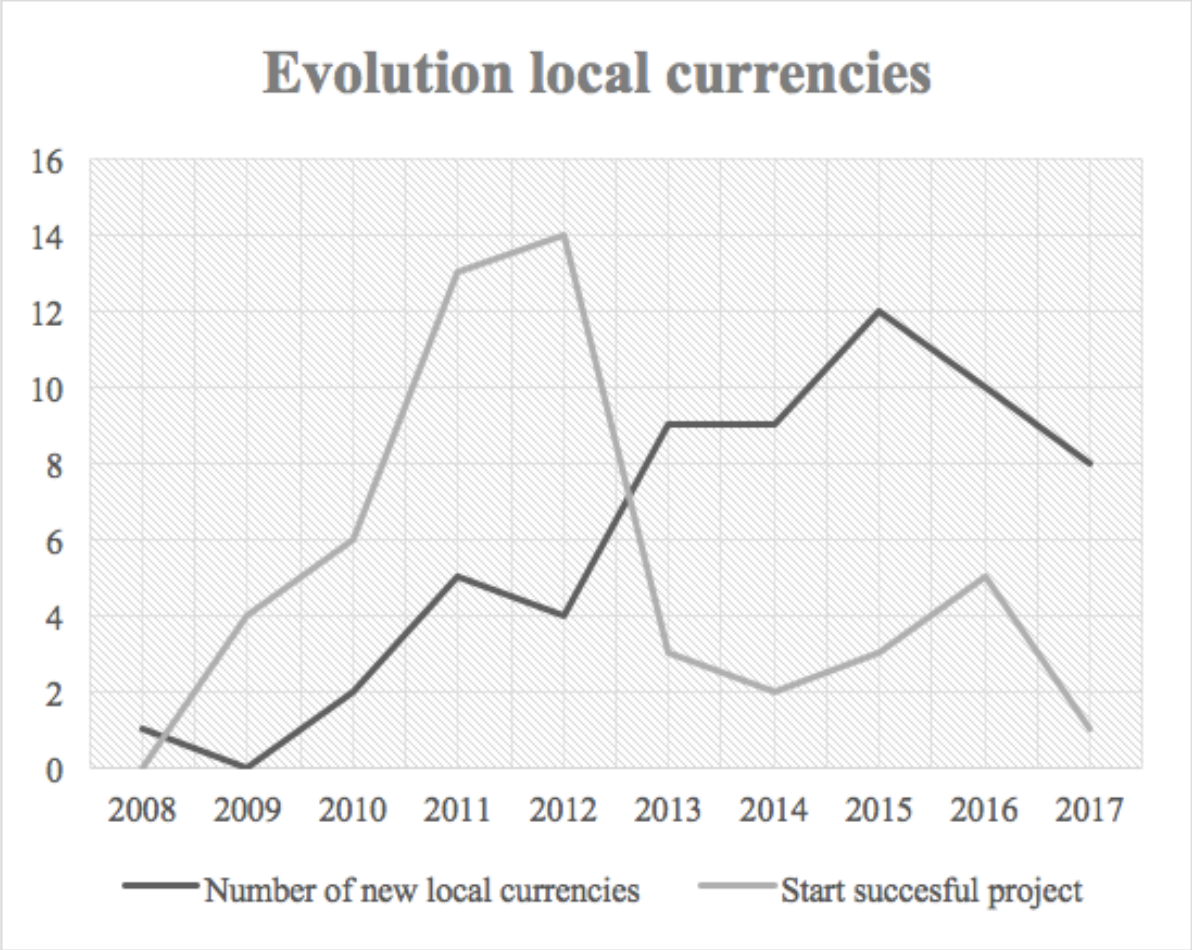
La Mige: La Monnaie Locale Creusoise [Public Facebook Group]. Retrieved January 22, 2018 from https://www.facebook.com/groups/lamige/

Le Lien, Monnaie Locale du Pays Stéphanois. (no date). *Le lien, c'est quoi?*. Retrieved January 22, 2018 from http://www.lelien42.org/index.php?page=2&#association

Tinda: Monnaie locale complémentaire Béarnaise. (Mai 28, 2016). *Historique de la Tinda.* Retrieved January 22, 2018 from https://www.demainenmain.org/doku.php/historique

Association la Sonnante. (no date). *Présentation de l'Association.* Retrieved January 22, 2018 from http://www.lasonnante.fr/association-lasonnante/

Seve. (no date). *La Roue, monnaie locale complémentaire de Provence.* Retrieved January 22, 2018 from https://www.laroue.org



The differences between the two totals come from the fact that the *Roue* and *Miel pôle* projects were created and launched together and are part of the same entity so they were only accounted for one time each. They are each considered to be one single project. Otherwise, the data would have been biased in the year 2011 with an abnormally high number of local currency projects created.

Also, there are two local currency projects, *Cep* and *Ostrea*, which had no data regarding the starting date of the project, only data regarding the launch of the currency. These two projects were thus not accounted for in the number of successful local currency projects launched.

2.2 Inflation

Year	Annual inflation rate
2007	1.50%
2008	2.80%
2009	0.10%
2010	1.50%
2011	2.00%
2012	2.00%
2013	0.90%
2014	0.50%
2015	0.00%
2016	0.20%
2017	1.00%
Mean	1.15%
Median	1.00%

Source:

Institut national de la statistique et des études économiques. (no date). *Taux d'inflation en 2017*. Retrieved January 23, 2018 from https://www.insee.fr/fr/statistiques/2122401#tableau-Donnes

2.3 Deficit

Year	Government deficit (in percentage of GDP)
2007	2.50%
2008	3.20%
2009	7.20%
2010	6.80%
2011	5.10%
2012	4.80%
2013	4.10%
2014	3.90%
2015	3.60%
2016	3.40%
2017	-
Mean	4.50%
Median	4.00%

Source:

Eurostat. (no date). *Government deficit/surplus, debt and associated data.* Retrieved January 23, 2018 from http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_10dd_edpt1&lang=en

2.4 M3

Year	Money Aggregate (M3) Yearly Evolution in the Eurozone
2007	11.08%
2008	10.43%
2009	3.80%
2010	-1.09%
2011	1.10%
2012	2.57%
2013	1.93%
2014	1.70%
2015	6.05%
2016	4.91%
2017	-
Mean	4.25%
Median	3.19%

Source:

OECD. (no date). *Monnaie au sens large (M3)*. Retrieved January 23, 2018 from https://data.oecd.org/fr/money/monnaie-au-sens-large-m3.htm

2.5 Income

Year	Household Disposable Income Annual Growth rate
2007	2.82%
2008	0.35%
2009	1.75%
2010	1.44%
2011	0.40%
2012	-0.32%
2013	0.05%
2014	1.30%
2015	0.98%
2016	1.75%
2017	-
Mean	1.05%
Median	1.14%

Source:

OECD. (no date). *Household disposable income.* Retrieved January 23, 2018 from https://data.oecd.org/hha/household-disposable-income.htm

2.6 Poverty rate

Year	At-risk-of-poverty rate
2007	13.10%
2008	12.50%
2009	12.90%
2010	13.30%
2011	14.00%
2012	14.10%
2013	13.70%
2014	13.30%
2015	13.60%
2016	13.60%
2017	-
Mean	13.41%
Median	13.45%

Source:

Eurostat. (no date). *At-risk-of-poverty rate by NUTS 2 regions.* Retrieved January 23, 2018 from http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tgs00103&plugin=1

2.7 Electricity

Year	Household and professional electricity consumption (TWh)
2007	-
2008	198.03
2009	202.28
2010	216.85
2011	196.24
2012	209.52
2013	216.99
2014	195.70
2015	202.57
2016	209.32
2017	-
Mean	205.28
Median	202.57

Source:

Réseau de transport d'électricité. (no date). *Statistiques de l'énergie électrique en France.* Retrieved January 23, 2018 from https://www.rte-france.com/fr/article/statistiques-de-l-energie-electrique-en-france

3. Models

3.1 Regional model

3.1.1 Correlation matrix

	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7
Y	1	-	-	-	-	-	-	-
X_1	0.035	1	-	-	-	-	-	-
X_2	-0.196	0.648	1	-	-	-	-	-
X_3	0.505	0.369	-0.265	1	-	-	-	-
X_4	-0.013	0.392	-0.104	0.149	1	-	-	-
X_5	0.475	0.070	-0.083	0.295	-0.079	1	-	-
X_6	0.591	-0.080	-0.081	0.369	0.303	-0.089	1	-
X_7	-0.384	0.078	-0.337	0.062	0.754	-0.125	-0.179	1

Y is the expected number of local currencies in a region

X_1 is the regional population

X_2 is the regional income per capita in euros

X_3 is the average regional household electricity consumption in MWh

X_4 is the regional poverty rate

X_5 is the binary variable depicting the presence of an independence movement

X_6 is the regional percentage of organic agriculture

X_7 is the regional long term unemployment rate

3.2 Time-series model

3.2.1 Coefficient values of the Regression Through Origin

Y: Dependent variable

	RTO of Model (3)
X_1	76.1741 (121.9255)
X_2	169.2388 (139.0086)
X_3	-47.1748 (49.6627)
X_4	-
X_5	430.4651 (227.6888)
X_6	-0.2729 (0.1611)
X_7	-
AIC	54.8821
BIC	56.0654
Adjusted-R^2	0.7003
P-value	0.06755

Y is the expected number of local currencies in a year

X_1 is the annual variation of country deficit

X_2 is the annual inflation rate

X_3 is the annual variation of money (M3) in circulation

X_4 is the annual variation of income per capita

X_5 is the annual poverty rate

X_6 is the annual household and professional electricity consumption in TWh

X_7 is the annual unemployment rate

3.2.2 Correlation matrix

	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7
Y	1							
X_1	0.304	1	-	-	-	-	-	-
X_2	0.323	-0.066	1	-	-	-	-	-
X_3	-0.486	-0.598	0.111	1	-	-	-	-
X_4	-0.407	0.310	-0.658	-0.038	1	-	-	-
X_5	0.766	-0.062	-0.074	-0.527	-0.395	1	-	-
X_6	0.086	0.237	-0.094	-0.374	-0.070	0.271	1	-
X_7	0.051	-0.201	-0.750	-0.377	0.195	0.599	0.225	1

Y is the expected number of local currencies in a year

X_1 is the annual variation of country deficit

X_2 is the annual inflation rate

X_3 is the annual variation of money (M3) in circulation

X_4 is the annual variation of income per capita

X_5 is the annual poverty rate

X_6 is the annual household and professional electricity consumption in TWh

X_7 is the annual unemployment rate