

Louvain School of Management

**In view of the history of money, is
the (crypto)currency a possible
future for European governments?**

Authors: Seyma Camuz & Manon Destailleur
Supervisor: Bruno Colmant
Academic year 2018-2019

Acknowledgments

First of all, we would like to thank our supervisor, Mr. Bruno Colmant, for his continued assistance throughout the writing of our thesis. His broad knowledge and understanding of the subject were really valuable to us.

Furthermore, we would like to thank the Louvain School of Management for the different programs and courses we had the opportunity to follow. They gave us the necessary tools to start our future career.

Finally, we would also like to express our gratitude towards our relatives for their continuous support and encouragement.

Abstract

In this thesis, we have explored the following problematic: In view of the history of money, is the (crypto)currency a possible future for European governments?

First, to answer this question, we have made an historical review of the different shapes money took throughout history, going from the shells to the cryptocurrencies. Early in the ancient times, currency held an intrinsic value, like gold coins for instance, until John Law issued the first notes which then separated the intrinsic value and the representation of such a value. We saw later on that once the government was in charge of printing the currency, the public institution was not always worthy of such a power and the general trust in governments was lost. Indeed, uncontrolled notes printing policies have led to financial catastrophes that had to be paid off by the citizens (F. Hayek).

Secondly, we have studied the impact for a state and for its citizens of the introduction of a (crypto)currency handled by the state. Among other things, the blockchain technology offers traceability and security but also concerns about the privacy of the citizens. “Crypto” is purposely written between parentheses in this case as it means “hidden” and a (crypto)currency handled by a state would not be secretive anymore. We have narrowed down our study to monetary ecosystems. We have studied the work of B. Lietaer showing us that such ecosystems increase the resilience of the financial system and therefore increases the quality of the system.

Finally, we have come to two scenarios that answer our problematic. In the first scenario, a government replaces its national currency by a (crypto)currency. This would lead to a similar situation as *Chicago Plan* where state money would be simply a stock that the government can inflate and deflate but the money creation by the commercial banks would likely disappear. Of course, for this scenario’s advantages to outweigh the disadvantages, the state has to be trustworthy. But as we learned, along with history, governments were often unworthy of such the privilege to issue money. Therefore, we do not consider this option as viable in a near future. In the second scenario, we consider that a government would launched a second currency, a (crypto)currency, as an alternative following the vision of B. Lietaer. We consider that, if this is done with clairvoyance, such a launch could lead to a positive situation similar to the WIR in Switzerland but with the additional advantages of the blockchain technology. Therefore, we believe this scenario is more plausible in a near future.

Table of contents

Acknowledgments	III
Abstract	V
Introduction	1
Part I: From Crude Form of Money to Cryptocurrency	3
1. About Currency	3
1.1. Aristotle: Functions of Money	3
1.2. Aristotle: The Need for Money	3
1.3. Conclusion	4
2. School of Thoughts About Money	5
2.1. Physiocracy	5
2.2. Mercantilism	5
2.3. Classical Economists: Adam Smith	7
2.3.1. Adam Smith compared to the Mercantilism & Physiocrats	7
2.3.1.1. Mercantilist and Free Trade	7
2.3.1.2. The Definition of Wealth	8
2.3.1.3. International Trades	8
2.3.2. The supply and Demand of Money: Specie-Flow Mechanism	8
2.4. David Hume	9
2.4.1 The Price-Specie-Flow Theory	9
2.4.2. Specie-Flow Theory (Smith) & Price-Specie-Flow Theory (Hume)	10
2.5. David Ricardo	10
2.6. Irving Fisher	11
2.6.1 The Quantity Theory	11
2.6.2 The Chicago Plan	13
2.7. Keynes	13
2.8. Conclusion	16
3. Objects	17
3.1. Non-Institutionalized Currencies	17
3.1.1. The Cowrie Shells	17
3.1.2. Native Americans: Woven Wampum Beadwork	18
3.1.3. The Yap Stone	19
3.1.4. Aztec and Cacao Beans	20
3.2. Institutionalized Currency	21
3.2.1. Salt	21

3.2.2. First Coins in China	23
3.2.3. Middle East currencies during the 3 millenniums BC	24
3.2.3.1. Electrum Currency (600 BC)	25
3.2.3.2. Cresus & Darius Coins	25
3.3. Conclusion	26
4. The Notes	27
4.1. First Notes in China	27
4.2. First Notes in Europe: a Swedish Invention	27
4.3. First Notes in France and the Inflation	29
4.3.1. John Law: the Premise of Modern Capitalism	29
4.3.2. French Revolutions and Assignat	31
4.4. Conclusion	35
5. Banking System	36
5.1. Central Bank under the First Consul	36
5.2. Monetary Union	37
5.2.1 The Germinal Franc	37
5.2.2. The Latin Union	39
5.3. Gold Standard System	41
5.3.1. The Gold Standard: Automatic Adjustment	42
5.3.2. The Gold Standard from 1914 until 1939	43
5.3.2.1. 1919-1926: Free Floating	43
5.3.2.2. 1927-1931: Short Return to the Golden Exchange Standard	45
5.3.2.3. 1931-1949: The Managed Floating	46
5.3.2.4. Conclusion	46
5.4. Bretton Woods (1944)	48
5.5. The IMF and the World Bank	50
5.6. IMF's Report concerning the Chicago Plan	50
5.7. Conclusion	51
6. The Fiduciary System	52
6.1. The Path to Euro	52
6.1.1 European Currency Snake	52
6.1.2. 1976 : Jamaican Agreement	54
6.1.3. The European Propositions for Monetary Stabilization	54
6.2. The Birth of Euro	55
6.3. The 2008 Crisis	55

6.4. Money Creation in 2019	56
6.5. Legal Tender	57
6.6. Conclusion	58
7. Complementary Currencies	59
7.1. Types of Complementary Currencies	59
7.1.1. Commercial Oriented	60
7.1.2. Community Oriented	60
7.2. Regional Currencies	60
7.3. Examples	61
7.2.1. Banco Palmas, Brazil	61
7.2.2. WIR Bank, Switzerland	62
7.2.3. Euskos	63
7.2.4. RES, Belgium	64
7.4. Conclusion	65
8. Cryptocurrencies	66
8.1. Blockchain Technology	67
8.2. Mining Process	69
8.3. History of Cryptocurrency	70
8.4. Bitcoin [BTC / XBT]	70
8.3.1. Launching	70
8.3.2. Means of Payment	71
8.3.3. Exchange Rate	72
8.3.4. Bitcoin: Quasi-Money	74
8.4. Other Cryptocurrencies	74
8.5. Cryptocurrency and the Governments: Practical Cases	79
8.5.1. Venezuela: Petro	79
8.5.2. Sweden	80
8.5.3. Estonia	82
8.5.4. Turkey	82
8.5.5. South Korea	83
8.5.6. Japan	83
8.5.7. Dubai	84
8.5.8. Switzerland	84
8.5.9. Belgium	84
8.6. Conclusion	85

Part II: The Future?	86
1. Are we going towards a cashless society?	86
2. Are the monetary ecosystems sustainable?	88
2.1. Different Point of Views on Monetary Ecosystems	88
2.1.1. F. Hayek: Fight of Currency, the winner has gold behind it	88
2.1.2. B. Lietaer: an Ecosystem of currencies, increased resilience	89
2.2. Conclusion	89
3. What are the advantages and drawbacks of cryptocurrencies?	91
3.1. Advantages	91
3.1.1. Decentralization	91
3.1.2. Immutable	91
3.1.3. Limited treat	91
3.1.4. Quick and No Fees	91
3.1.5. Safe Data	92
3.2. Drawbacks	92
3.2.1 Crash	92
3.2.2. Volatility	92
3.2.3. Connexion	92
3.3. Conclusion	92
4. Are cryptocurrencies a possible future for European governments?	93
Final Conclusion	97
The answer to our Problematic	98
Scenario 1: The “(crypto)currency” (digital currency) becomes the unique currency in the system	99
Scenario 2: The “(crypto)currency” (digital currency) is an alternative to the national currency	99
Limitations	101
Bibliography	102
Appendix	115
Appendix 1: Crypto ATM Installations Growth	115
Appendix 2: Bitcoin ATMs by Country	116
Appendix 3: Crypto ATM support for buy and sell transactions	118

List of Figures

Figure 1:	Quantity theory of money
Figure 2:	Cowrie shells
Figure 3:	Wapum Belt and Wapum String
Figure 4:	Yap Stone
Figure 5:	Ethiopian salt bar (700-900g/ 20-25cm) still in use today
Figure 6 & 7:	The “pu” & the “tao”
Figure 8 & 9:	The “tao” becomes a coin
Figure 10:	Electrum coins
Figure 11:	Electrum coins Cresus & Darius
Figure 12:	Electrum coins Darique
Figure 13:	Copper plaque
Figure 14 & 15:	First Swedish “Notes”
Figure 16:	French Note
Figure 17:	Assignats 1
Figure 18:	Counterfeit
Figure 19:	Laws against the counterfeits
Figure 20:	Mandat territorial
Figure 21:	Franc Germinal
Figure 22:	Propaganda image for the Latin union (1900)
Figure 23:	Real GDP
Figure 24 :	Inflation rate
Figure 25:	Increase in the price of a stamp
Figure 26:	German inflation
Figure 27:	The European Currency Snake
Figure 28:	Cryptocurrency mining equipment
Figure 29:	Bitcoin ATM
Figure 30:	Interest in Bitcoin tracks and value of Bitcoin
Figure 31:	Bitcoin price graph
Figure 32:	Cryptocurrencies comparison
Figure 33:	Bitcoin and Ethereum: joined at the hip

Introduction

As soon as humankind has begun to trade, the need for a common way to appreciate the worth of one's work has risen. The sedentary populace used mostly barter to operate exchanges. The need for a common currency appeared with the nomadic folks as the transportation of valuables became a necessity. Therefore, a recognizable symbol in time and space had to be created to allow trades (Colmant, 2017). Along history, money has taken many different shapes and has been assimilated as a sovereign right. Seeing the latest form this means of exchange has taken - cryptocurrencies - the question rises on what place will they take in today's financial world.

The two main concepts in this thesis are currency/money and cryptocurrency as we go through history and see how the transition was made from one to the other. The word money is strongly related to physical coins. Indeed, "Money" comes from the goddess Juno as the coins were struck in at her Temple: Juno Moneta. Its origin ally means coins and the wealth idea related to it is only secondary (Lord Avebury, 1902). A currency is a money that is used in an economy and generally issued by a government. In this thesis, we will also study the types of currencies that are not issued by a government. Currencies are a medium of exchange that gives fluidity to trade (Investopedia, 2018). A cryptocurrency is a digital or virtual currency using cryptography for security. Many of them are decentralized based on blockchain technology (Investopedia, 2019).

This thesis focuses on the fact that a cryptocurrency (which is as explained here above decentralized and not a regal right by definition) could be issued by a government. After discussing with our thesis master, M. Bruno Colmant, we have decided to do a historical review of money and currency. This allows us to study the emergence of cryptocurrency handled by the states with a retrospective point of view on what happened in history. Our problematic is therefore and without surprise: In view of the history of money, is the (crypto)currency a possible future for European governments? We willingly put the word "crypto" between parentheses. We are indeed speaking of the cryptocurrency technology but the word "crypto" means hidden and by definition a cryptocurrency handled by the state would not have any hidden parts anymore.

On the advice of M. Bruno Colmant, we have established a chronological plan to answer to our question. In the first part, we have initially developed the functions and the need for money according to Aristotle. We have then compared the different school of thoughts about money going from the physiocrats & mercantilists to Irving Fisher and J. M. Keynes. In the following part, we have done a review of the different objects and notes that have been used as money. We have focused our study on special/particular items. Additionally, we have studied the first forms of monetary unions and the emergence and the final end of the gold standard system (by president Nixon in the 70s). Furthermore, we have analyzed the fiduciary system. We have considered that President Nixon's decision was the chronological step that led to the fiduciary financial era as the dollar has become a "fiat money". Thereafter, we have studied the complementary currencies that are emerging more in our world. Finally, we have studied the cryptocurrency mechanism and practical cases around the world. In the second part, firstly, we have elaborated the idea of a cashless society. Secondly, we have analyzed the benefits of a dual monetary system within a country. Then, we have evaluated the features of cryptocurrencies and finally, we answered our question.

Part I: From Crude Form of Money to Cryptocurrency

1. About Currency

In this first section, we will try to define where does the need for money come from and how to define a substance as particular as money. We will start with the classical definitions of Aristotle and will afterwards describe some additional views on money.

1.1. Aristotle: Functions of Money

According to Aristotle, the currency holds three different purposes. First, it is a unit of account allowing a common ground between buyers and sellers while trading, this value is determined through a convention. Currencies are not natural nor ineluctable. Secondly, as said above, currencies play also the role of an intermediate for trade allowing to move away from barter. Indeed, everything that is exchangeable must be comparable (how many sheeps would you need for a cow). The existence of a common currency facilitates those exchanges as the price is set and the mean of exchange is already established. Finally, the currency has the function to store value in time as it is a guarantor that it could be used later on (Moreau, 1969).

1.2. Aristotle: The Need for Money

Aristotle also studied the need for money. The need for money comes first from the need for barter. The latter appears when the exchanges are made with a larger group than just the family (everything being shared in the latter). The first trades are necessary trades, meaning that only vital goods such as wheat and grains were exchanged. The need for a currency appears when importation and exportation (of non-vital goods) began. In other words, it appears when we entered the “money-merchandise-money” cycle coming along with trades. It was then soon decided to use for the exchanges a good that was convenient and handy in every day's life: Iron. The size and the weight of the coins were defined and later on the coins were marked with a particular footprint in order to avoid unnecessary verification (Villey & Neme, 1985). Aristotle also reminds us that the currency in itself is vain. Indeed, its worth is defined by law and not by nature, meaning that a change of convention can depreciate it at any point (Doyen, 2018). Aristotle also despises the loans with interest as the mean of currency is deviated. Indeed, it makes money in itself where it should only facilitate trades (Villey & Neme, 1985).

It is interesting to note that the storing value of a currency is strongly related to the capacity of a government to earn the trust of the citizen. The trust that the currency will still have its worth in the future and therefore that hoarding this currency is a way to hold on wealth (Colmant, 2017).

1.3. Conclusion

In this section, we have defined what is money. The most classical definition is, of course, Aristotle's. We should keep in mind that money is a circumstantial and non-lasting phenomenon that allows the gathering of wealth and societal status (Colmant, 2018). Later in this thesis, we will use the classical definitions of currency in the context of cryptocurrency. We should also keep in mind that money can also be considered as an object that we have to work to obtain. In this view, cryptocurrencies (such as the bitcoin with the blockchain technology) are a currency (Colmant, 2017).

2. School of Thoughts About Money

In this second section, we will study different economic views on money and wealth that emerged along history. Those economic views go from what makes the wealth of nations to the impact of issuing money on the general price level. This overview will help us later on with our analysis.

2.1. Physiocracy

Physiocrats were part of a French movement called physiocracy. They called themselves the “économistes” and were a very vindictive courant. They went as far as equipping themselves with their own press tools. Even though the ideas of the movement were dominant for only a quarter of a century, their political impact was important (partly because of the central cultural position Paris held back in the time). The main leader of the group was François Quesnay (1694-1774) (Roncaglia, 2006).

Physiocracy is a theory of wealth. It states that a nation's wealth relies only on its agriculture. The etymology of the word physiocracy (from Greek) expresses this idea well: *fusis* means nature and *cratein* means to dominate. This word is not only linked to agriculture being the key sector to produce wealth but also to the fact that a “natural order” should be followed. The physiocrats shared this last idea with the French enlightenment (Roncaglia, 2006).

According to François Quesnay, the farmers are the only category able to produce wealth (“Who were the physiocrats?”, 2013). More specifically, physiocrats believe that agriculture is the key social category as it was the unique sector that could produce a surplus. The physiocrats identified three categories. First, the peasants and farmers active in agriculture being the productive class. Secondly, the artisans (the manufacturing workers were included) which were the sterile class. Finally, the landlords (aristocratic class and the clergy) that gathered the surplus produced by the agricultural sector (Roncaglia, 2006). The vision of the physiocrats was quite limited as they were unable to see that manufacturers could also indeed create wealth (“Who were the physiocrats?”, 2013).

2.2. Mercantilism

The dominant economic theory between 1500 to nearly 1800 was Mercantilism. The mercantilists were deeply convinced that the economic health of a nation was based on the

supply of capital it owned. More specifically, the mercantilist believed that the wealth of a nation was based on the amount of precious metal that was held in its treasury (Investopedia, 2019). Indeed, according to them, only precious and lasting in time goods could be considered as wealth (such as gold, silver or jewelry) (Colmant, 2018).

To increase this amount of metal, the mercantilist advised nations to increase their exports and limit their imports. Nations that were influenced by mercantilism tended to use their military powers to secure their market and the sources of supply goods in order to be able to export goods and increase their wealth in metals (Roncaglia, 2006). This situation led to a constant state of war between France, England, Portugal, and Spain, as those countries were fighting to dominate the seas. As a side effect, those countries also increased their exploration in the world to find new expensive goods to export (Investopedia, 2019).

Great-Britain was influenced by mercantilism so heavily that it led to numerous trade restrictions which slowed down the growth of businesses in the colonies. England applied some specific fiscal policies in order to successfully achieve this “favorable” balance of trade. One of those policies, for instance, was the Navigation Act (1651), this policy forbade to foreign boats to trade on the British coast. Moreover, the goods coming from the colonies had to go through the British control before it could follow its way in Europe (Investopedia, 2019).

The British government obliged all transactions to be operated with bullions (silver or gold). When the ingots were lacking in the colonies, the decision makers would issue paper money. We will see that, along with history, the issuance of paper money often led to huge catastrophes like high inflation. The paper money issued by the British at that time was no exception and led to an inflationary period. This phenomenon combined with a nearly constant state of war (requiring high taxation) led to a colonial dissatisfaction (Investopedia, 2019).

Mercantilism also had an impact in France, especially through Jean-Baptiste Colbert (1619-1683). Jean-Baptiste Colbert was one of the most important ministers in France under the reign of King Louis XIV. Jean-Baptiste Colbert was highly devoted to the crown (C. Rule, 1996). He had studied the economic theories concerning foreign trades and was powerful enough thanks to his political position to give life this economic theory. He increased France’s military forces on the sea in order to guarantee the safe passage for the French exports. Jean-Baptiste

Colbert's mercantilist policies while extremely popular at their time were ultimately unsuccessful. His mercantilist theories were beaten of by Adam Smith's theories on free trades (Investopedia, 2019).

2.3. Classical Economists: Adam Smith

The classical school of thoughts emerged after the rise of western capitalism in the 18th and 19th centuries (after western capitalism was born and the industrial revolution occurred). Adam Smith's book the "Wealth of nations", issued in 1776, develops and explains some of the most important ideas and developments of the classical economic theory. It is the first attempt in explaining how capitalism works (Investopedia, 2019).

The classical thinkers are of course not completely unified in their views and conclusions, but common ideas can be identified in the classical school of thought. The vast majority of those thinkers were strongly in favor of a free market. Moreover, they were adamantly opposed to an intervention of the government and were strongly in favor of a looser type of market called the *laissez-faire* (Investopedia, 2019).

In his book the wealth of nations, the Scottish economist made a famous observation in the economy: companies and people when meeting on markets follow what is called the invisible hand pushing them to make the decision following their best interest (Mankiw & Taylor, 2014). This is a major change from the mercantilists and physiocrats views as this means that a healthy economy leading to wealth can come from everyone rather than from a state decision to limit imports, for instance.

Compared to the mercantilists and the physiocrats, Adam Smith states that the wealth of a country is nor the surplus of the land nor the precious metals but the products that embellish the life of the nation. The precious gold and silver are simply a mean of exchange (Colmant, 2018).

2.3.1. Adam Smith compared to the Mercantilism & Physiocrats

2.3.1.1. Mercantilist and Free Trade

As explained above, the mercantilist ideas of Jean-Baptiste Colbert were ultimately beaten by the free trade theory of Adam Smith. Indeed, free trade theory gives a bigger choice of

affordable goods to all individuals. This is a simple consequence of the difference between a free market and a market with limitation on the imports, which leads to an increase in price as there is less competition between the sellers, as did the mercantilist (Investopedia, 2019).

Moreover, during the mercantilism influences, the countries were constantly at war in order to ensure their exports. In the free trade canva, all countries can beneficiate from mutual trades. Following Adam Smith's vision of the labor division, each country can specialize in manufacturing goods for which they have an advantage which leads to higher productivity as well as an increase in the economic growth (Investopedia, 2019).

2.3.1.2. The Definition of Wealth

For the physiocrats, wealth is the land as it is the mean for the creation of wealth (Colmant, 2018) For Adam Smith, labor (the time dedicated for a task) is a unit for wealth, it constitutes a unit of account for trades (Investopedia, 2019). And wealth is anything that improves the life of the nation. For the mercantilist as said above, wealth is measured by the precious and lasting goods such as gold, silver, and jewelry (Colmant, 2018).

2.3.1.3. International Trades

Adam Smith positions himself once more against the mercantilists concerning the international trades. The mercantilists believe the country importing goods is losing wealth while the one exporting is gaining wealth. This means that the sum of it all is equal to zero and that protectionist measures have to be taken (Investopedia, 2019).

According to Adam Smith, international trades are beneficial to all parties as it allows each country to specialize in specific manufacturing leading to an increased economic growth thanks to the division of labor (FTV Education, 2013).

2.3.2. The supply and Demand of Money: Specie-Flow Mechanism

The specie-flow mechanism is a theory emitted by Adam Smith that has as a goal to explain how the amount of currency in the different countries regulates. He studied the supply of money and then the demand for money before going to its conclusions (A. Currot, 2016).

When it comes to determining what is the supply of money, Adam Smith gives the following answer: in terms of metal coins the supply depends on the richness or on the poverty of the mines (A. Currot, 2016). Adam Smith explains that the specie has a relative price equal to:

“The proportion between the quantity of labor which is necessary to bring a certain quantity of gold and silver to market, and that which is necessary in order to bring thither a certain quantity of any other good.” (quoted in A. Currot, 2016, p.6)

Concerning the demand for money, Adam Smith considers that the only purpose that inhabitants have to hold/want money is to allow and facilitate the circulation of trades (of goods and services). Therefore, the inhabitants only desire an amount of money that allows them to put their goods in circulation and have no interest in holding more or less than this amount (A. Currot, 2016).

According to Adam Smith, if there is an excess, it will stay unused on the domestic level as the domestic circulation is complete. All inhabitants have enough coins to do the needed transactions. But this excess can be used on foreign markets to purchase foreign services or goods. This means that the coins are thrown out of the circulation of the country. This shows that Adam Smith saw money as a mean of exchange and not to store value (A. Currot, 2016).

Adam Smith's specie flow mechanism states that the amount of specie is self-regulating in every country. According to A. Currot, Adam Smith's view on demand is not as clairvoyant as he considers the demand as being fully inelastic (an inelastic demand means that the consumers will buy the same quantity of money, unrelated to the price of the good) (A. Currot, 2016). Adam Smith's theory will be improved by David Hume.

2.4. David Hume

David Hume is a Scottish economist that lived in the 18th century (1711-1768) (The library of Economics and Liberty, n.d.).

2.4.1 The Price-Specie-Flow Theory

David Hume, as Adam Smith, positioned himself against the mercantilist and their vision to stop the importation:

“These errors, one may say, are gross and palpable: But there still prevails, even in nations well acquainted with commerce, a strong jealousy with regard to the balance of trade, and a fear, that all their gold and silver may be leaving them.” (Hume, 1752, p.1)

Indeed, according to him, the fact to encourage exports (and therefore increasing the wealth) and limit imports does not, in fact, increase the amount of wealth in a country. The argument of Hume was that the prices in a country change proportionally to the specie supply in this country. A country exporting a lot and therefore seeing more gold in its treasure, will see its prices increase. As the country is now relatively more expensive than its neighbors it will limit its exports and increase the imports. According to David Hume, the balance of trade comes naturally back to the neutral balance (Hume, 1752) This theory stands as long as the country remains on the gold standard on fixed adjustment (meaning until WWI, this will be explored later on in this thesis) (Université de Renne, n.d.).

2.4.2. Specie-Flow Theory (Smith) & Price-Specie-Flow Theory (Hume)

According to Nicholas A. Currot, Adam Smith fails to explain in his specie-flow theory for which motive individuals would send their money abroad in the case of an excess of supply in their own country (as A. Smith considers that there is no need nor advantage from it). The explanation of this phenomenon can be found in David Hume price-specie-flow theory. David Hume explains in his essay the “Of the balance of trade” that a domestic increase in specie will increase domestic prices. This situation does that the foreign goods are relatively cheaper, therefore individuals guided by their own interest (such as the invisible hand) will spend their specie on foreign goods. This phenomenon drives the market back to the equilibrium. The weakness of Adam Smith theory resided in the fact that he presented the situation as if the excess of money would simply be taken away as there was no use for it in the domestic economy (A. Currot, 2016).

2.5. David Ricardo

D. Ricardo (1772-1823) is seen by many people as the father of the liberal economy. This British economist read Adam Smith’s book “the wealth of nations” in 1799 and became a strong defender of the free trades also (Investopedia, 2018).

D. Ricardo argued for the benefits of the free trade based on the comparative advantage. This can be seen as a step further compared to the division of labor of Adam Smith. Indeed, D. Ricardo stated that if each country specializes in making a good in which it has a comparative advantage (even a small comparative disadvantage) then by trading their surplus with other

countries, all parties are better off. Moreover, D. Ricardo was strongly opposed to any forms of protectionism as it only benefited the protected party (Ricardo, 1821).

D. Ricardo also states that wealth does not stand in the production of money. And that the fact that Central Banks create money to encourage business to invest does not, in fact, increase the wealth. In 1810, Ricardo published his first book of major importance “The High Price of Bullion, a Proof of the Depreciation of Bank Notes”. In this book, he stated that the inflation happening in England at the time was due to the tendency of the central bank to issue new money over and over. After investigating, the government came to the same conclusion (it is not proved however that the investigation was a consequence of Ricardo’s first book, but it allowed him to grab the attention of the audience as an economist) (Federal Reserve Bank of Dallas, 2004).

The very innovative vision of Ricardo’s theories is the Barro-Ricardo equivalence proposition. It states that when a government uses debt to stimulate the spending in its economy, it does not actually work. Because an increase of debt now, and potential revenues paid with this debt, will eventually become of raise in taxes to pay back the debt and the interest. Therefore, as the individuals are believed to make their decision rationally, they will rather spare their money in prevision of these future taxes rather than spend their money (Colmant, 2018). In conclusion, even if the governments try to increase the spending, the demand remains still (Investopedia, 2018).

2.6. Irving Fisher

Irving Fisher (1867 - 1947) is one the most famous neoclassical American economists. He was born and died in New-York. In the big city, he also studied at Yale university and wrote a PhD on mathematical economics (Federal Reserve Bank of Dallas, 2005).

2.6.1 The Quantity Theory

About the quantity of money, I. Fisher states that:

“Other things remaining unchanged, as the quantity of money in circulation increases, the price level also increases in direct proportion and the value of money decreases and vice versa.” (Economics Discussion, para. 2)

This statement is part of his theory on the quantity of money and is best explained with the use of his equation of exchange, the theory goes as followed (Economic Discussions, n.d.):

$$M * V = P * Y$$

Where M is the quantity of money in the economy, V is the velocity (the number of times the money is used in the economy). Those two elements being multiplied represent the nominal GDP on the buyer's end. P is the price in the economy and Y is all the goods being sold, it is the supply of money. Those two items being multiplied represent the nominal GDP on the sellers' end. This is the demand for money. And as everything being sold is bought therefore the equation well stands (Roncaglia, 2006).

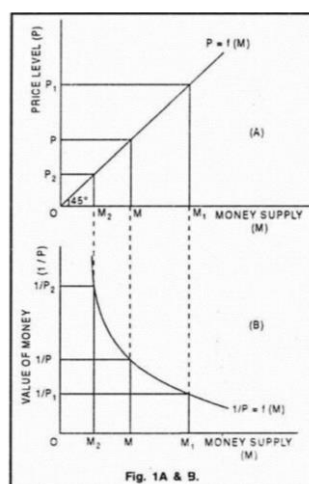
Fisher with the assumptions that in the long-term in an economy with full employment, the velocity (V) and the total volume of exchanges (Y) are independent, in other words, remain still, made the connection between the amount of money in the economy and the price (Roncaglia, 2006).

The new equation becoming:

$$P = (M * V) / Y$$

The graph here below (Economic Discussions, n.d) shows the relation between the quantity of money and the prices. If the quantity of money increases the value of this money diminishes as the prices increase.

Figure 1: Quantity theory of money (Economics Discussion , n.d., para.15)



2.6.2 The Chicago Plan

In the years following the crash of 1929, called the great depression, proposals from the University of Chicago have emerged in favor of a Monetary Reform. The crash was seen as the last historical event demonstrating that private control of money led to greater issues than money creation being handled by governments. The economists supporting the Chicago plan (the monetary reform) were well aware that money creation handled by banks implied a high level of debt in order to be able to create enough supply of money. Another obvious issue for those economists was the fact that banks tend to be too optimistic concerning the business future outcomes. Globally, the Chicago plan offers a switch from a system where the money is issued from private debts to a system where money would be issued by the government without debt needed (International Monetary Fund, Benes & Kumhof, 2012).

This Chicago plan had the support of many brilliant economists such as I. Fisher. Even though during this period, I. Fisher was in very close contact with the Roosevelt administration that had serious interest in this reform. The monetary and banking reform proposal did not lead to actual legislation due to strong opposition from the banking industry. I. Fisher was a strong supporter of the Chicago because, among other things, he considered that the extremely high level of debt was the cause of many economic crises (International Monetary Fund and al., 2012).

2.7. Keynes

J. M. Keynes (1883-1946) is a British economist that focused part of his work on the long-term unemployment and how to cope with such an issue. His father John Neville Keynes was an ardent supporter of the free-market theory and so was J. M. Keynes at the beginning of his work. But later on, the British economist will encourage the interventions of the government and will refute the classical economic theories evoked here above in this thesis (as well as the Ricardian equivalence, Adam Smith's free market) in times of crisis (Roncaglia, 2006).

Keynes criticized the Ricardian equivalence (described above in section 2.5) because he believed that the assumptions this theory is based on are unrealistic. Indeed, the theory assumes that the economic agents being rational would save up their money when the state took a debt in fear of tomorrow's higher taxes. But in fact, there is no certainty that the consequence of this debt might not occur during the life of those economic agents. Therefore, nothing proves that they would save rather than spend this amount (Investopedia, 2018).

About the quantity of money theory of I. Fisher, Keynes' main critic stands in the assumption that the economy is under full employment. Indeed, in the case where there is no full employment (such as during the time between the two world wars that J. M. Keynes lived in) the proportional relationship between price and the amount of money is not guaranteed. Moreover, Keynes did not consider that the velocity of money could be considered as constant.(Delong's Grasping Reality, 2013). Keynes lived in the post-World War I period, a time where Great Britain decided to go back to the gold standard. As often during war times, countries leave the gold standard because it would limit the issuance of money needed for the tremendous spending needed in such periods. The convertibility of the money to go back to gold is suspended and inflation occurs (see Fisher quantity theory). Great-Britain under the governance of Winston Churchill had a deflationist policy leading to a lot of unemployment. Ultimately after that this policy made a lot of damage, Great-Britain left the gold standard in 1931 (France culture, 2017).

Keynes wrote another article where he criticized the use of the gold standard and the quantity theory. In one of this paper "*Dangers of the gold standard*", Keynes speaks about the inflation and unemployment that are the consequence of the deflationist policy of that time in Great Britain (The National Archives, 2018). By doing so, he goes against classical theories promoting an equilibrium of the gold standard as a source of stability during depression times. Keynes has the intuition that this system could not ensure a domestic stability of the prices. As a consequence of this reasoning, Keynes does not consider money as being neutral. Specifically, Keynes disagreed with the idea that the amount of money only impacts the level of prices. Moreover, he does not believe that the real variables (such as the rate of employment or production) would stay unaffected by it. The British economist considers that money should be controlled to ensure price stabilization (Alessandro Roncaglia, 2005).

In term of a global view of the cycle of economy, the classical economists state that the changes in employment and economy production are minor and self-adjust. Indeed, according to those thinkers, if the demand drops, the production will diminish, and both of those things will have as a consequence that the salaries and the prices will decrease. With this phenomenon of lower wages, employers will hire new employees which would restart the economic growth. Keynes strongly disagreed with this view, as he argued that no employer would hire more workers if there is no demand and therefore no reason to produce (Investopedia, 2019).

In his paper, “A tract of the monetary reform” (1923), Keynes criticizes the quantity theory and the free-trade market. He states (where n is the quantity of money and p the price):

“It would follow from this that an arbitrary doubling of n , [...], must have the effect of raising p to double what it would have been otherwise. The Quantity Theory is often stated in this, or a similar, form. Now “in the long run” this is probably true. [...] But this long run is a misleading guide to current affairs. In the long run, we are all dead. Economists set themselves too easy, too useless a task if in tempestuous seasons they can only tell us that when the storm is long past the ocean will be flat again.” (Keynes quoted in Delong's Grasping Reality, 2013, pp. 80-82)

In this paper, Keynes shows that he does not believe in a free-market (especially in the time of depression that he lived in) and that he believes in an intervention of the state to help the economy (Delong's Grasping Reality, 2013).

Keynes, in the situation of the great depression especially, states that in the cases of bad economy, governments should apply more spending or in other words have a deficit policy to increase the consumption. This allows the government to cope with the lack of investment as a consequence to increase and stabilize the demand. Keynes expressed those ideas in the context of the depression. The British government decided to increase the taxes and stop welfare spending. According to Keynes, those decisions would leave the British economy unstimulated and keep it from recovering. In all logic with his view, Keynes recommended an increase of government spending to stimulate the demand, restart the economy and reduce unemployment. Indeed, Keynes considers that wages, prices and so on are too slow to adjust to help the market regain its health (The National Archives, 2018).

Concerning the role of currency on a more philosophical side, Keynes stated that currencies are a way to maintain social order. Indeed, mankind does not have to fight to get the goods needed but for the artifact representing the good's worth. As an illustration, currencies were able to free humans from slavery as they were able to repay their debt using money instead of giving up their freedom (Colmant, 2017).

2.8. Conclusion

It is obvious that depending on the times of history, different economic views have emerged before being contested by most recent theories.

The mercantilist and the physiocrats were criticized by Adam Smith (among others) in their vision of what the wealth of the nation is. Nowadays, wealth can be considered as the earnings that one can get on the financial market. Such earnings can come from cryptocurrencies such as the Bitcoin (even though the fuzz around the bitcoin can be considered as financial bubble).

About the way currencies adjust in an international market, Adam's Smith specie-flow theory was improved by David Hume's price-specie-flow theory. Hume's theory explains that currencies self-adjust as an increase in wealth leads to an increase in prices that encourages the 'new rich citizens' to spend their money abroad as the prices are comparatively lower. This shows that the system goes back to the equilibrium. We will show later in this thesis with a numerical example that this is how the gold standard self-adjusts under the fixed-adjustment.

Later on in this section, we have seen how the economic thinkers, not only criticized their predecessors but also the state. David Ricardo had a hard look at the English central bank and blamed the financial instances for the increase in prices. The quantity theory of Irving Fisher (that is still today very much used) has been criticized by J. Keynes as he considers that it only holds under an economy of full employment. J. Keynes criticized globally the theories of Adam Smith and strongly encouraged the state (in the tough economic situation that occurred after the war) to invest in order to help the economy get back on their feet.

Later in this thesis, the quantity theory will appear regularly as when the states issue too many notes/coins, inflation occurs. We will also speak about Keynes as he is one of the investigators of the Bretton Woods agreement. Later on, we will also study the advantage of having a cryptocurrency where the total stock of currency is still (as in the bitcoins). Finally, we will study in the second part of this thesis the views of two additional authors: F. Hayek and B. Lietaer. With these additional views, we will explore different analysis on whether an ecosystem with multiple currencies in one state is a viable solution.

3. Objects

In Europe, cattles are believed to have been used to barter since the 9000 BC until the 6000 BC (Unichange, n.d.). In fact, the word *pecunia* comes from latin *pecus* meaning cattle. But barter is complicated and cumbersome. Therefore, many civilizations began to use specific objects to trade (Lord Avebury, 1902). We will in this section present some of the objects that have been used for trade along history going from the shells to the familiar coins still in use today.

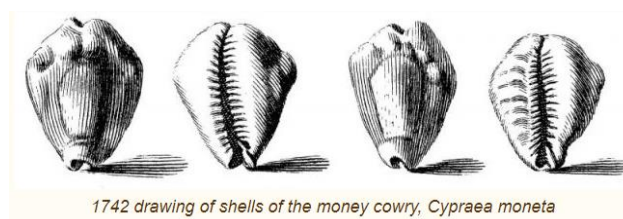
3.1. Non-Institutionalized Currencies

We will here study non-institutionalized currencies used as an amelioration from barter. At this stage, superior institutions are not, per se, involved yet.

3.1.1. The Cowrie Shells

Since more than a thousand years BC, the use of cowrie shells was the first form of currency that was utilized instead of barter. Those shells were used in many parts of the world such as India, Ancient China, Africa (Lord Avebury, 1902). The shells were perfect to use as a currency as they were small, easy to carry, solid and lasted in time. (National Bank of Belgium, n.d.).

Figure 2: Cowrie shells (The vintage news, 2018, para 13)



The first culture to use the cowrie shells is believed to be ancient China, since 2000 BC from the Shang dynasty to the Zhou dynasty (Yang, 2011). The empire needed a common currency to handle the trade in its extremely expanded territory. Among its other qualities, cowrie shells were hard to find as a natural resource in China (only found in the seas far south) which guaranteed no use of counterfeit. The use of the shells was so well implemented in ancient China that in Chinese the words goods, stores, purchase, wealth and many others stand the ideographic sign meaning "shell" (貝) (Lord Avebury, 1902).

Traces of the use of cowrie shells have been found early in history in the Pacific and Indian ocean as well. The numerous inhabitants living in the Maldives, for instance, were gathering

to search and prepare the shells for future trades. The geographical closeness of the shells gave life to a real industry of the currency (The vintage news, 2018).

Along history, merchants from Arabia have introduced the shells in the African markets (especially Zanzibar and Ethiopia) where they spread through the all continent. Colonizers seeing the immense potential of such a currency have used it to buy what they needed such as gold and slaves. The use of shells being dominant, it conducted to the disappearance of multiple local currencies (The vintage news, 2018).

The value of the shells relied on the simplest economic law: supply and demand. The farther the trade place was from a source of shells the more the value increased. Where the shells could be found at the beach directly, the worth declined. Another way to value the currency was to consider the time needed to prepare and curve them. So, the more sophisticated and the more time-consuming was the shell the more valuable it was on the market. Such a system was also used by Adam Smith to estimate the value of a good (The vintage news, 2018).

The shells were used until the half of the 20th century. They are still used in Papua New Guinea as a currency by the nostalgic. Cowry shells are represented on the facade of the West African Central Bank in Mali. This shows the huge place occupied by the shells for such a long time in history (The vintage news, 2018).

3.1.2. Native Americans: Woven Wampum Beadwork

Shells have also been present in the Native American culture, the first traces of those objects are really hard to find but their existence has been reported by European travelers as soon the fifteenth century. With these shells, the Native Americans manufactured *wapums* or *proto-wapums* in this early stage of history (Lainey, 2004).

Figure 3: Wapum Belt and Wapum String (Library and Archives Canada Blog, 2015, para.3)



The word *wapum* can be used to describe several different things but in this thesis, we refer to specific beads made of cylindrical shells of the colors white and purple. The beads composed

Iroquois belts that were eventually used as a currency in North America. The raw materials (the shells) were found on the shores of the Atlantic Ocean but to obtain bicolor belts two different types of shells were needed. The white beads could come from *columella*, *Busycon carica* and *Busycon canaliculatum* while the purple ones came from a shell called *Mercanaria mercanaria*, the thread used in the belts came from deer tendons (Lainey, 2004).

The use of the shells was well spread among the native Americans living on the coast but not among the natives living inside the land (the *Iroquois* for instance). It is difficult to establish when the shell beads began to be traded between the Amerindian living at the ocean and those living in the center, but it began before the Europeans arrived in America. Traces of the use of the wampums as currency go back to at least the 17th century. The shells became crucial for European in the trade because it allowed them to purchase the fur sold by the centered native Americans. It was even more so that metallic coins were running short in North America at that time. By trading the shells with the Iroquois, Europeans were hoping to encourage the fur traffic to the coast to be able to ship it to Europe. The *wapums* were perfect to use as a currency as they were small, light, lasted in time, took a long time to be made, a lot of those characteristics are similar to the cowry shells for obvious reasons (Lainey, 2004).

3.1.3. The Yap Stone

This currency only exists on the island of Yap in Micronesia and is one of the biggest you can find on earth. It is in fact so odd that it has been mentioned in numerous economic books such as Mankiw, Baumol & Blinder and many more.(The E-Sylum, 2013). It has been used for centuries but no certainty about when it began exactly as the inhabitants follow an oral transmission tradition. The first mention of it by a non-native was made by the missionary Father Jean Cantova in a letter written in 1722 (Lee C. Gilliland, 1975). The Yap stone is round and has a diameter going from 0.4 to 4 meters with a hole in the center. They are referred to as rai or fei. They are composed of *aragonite*, a mineral found in the islands of this area of the world (BBC & Poole, 2018).

Figure 4: Yap Stone (Barach, 2016, para.1)



There are around 6600 of them and they are only used for huge expenses (SAR Publisher, 2019). This system was prevented from inflation as the number of stones stays still in time. This situation is in harmony with the quantity theory of I. Fisher. Those stones have been carved and conveyed by the Japanese from another island (Palau) situated 450 kilometers away South-west of the Yap island (BBC & Poole, 2018).

Moreover, it is impossible to steal the stones because of their size and because broken they become worthless. Therefore, the heavier stones are usually untouched, and the villagers simply write down who they actually belong to (Bordes, 2009). Which can be considered as similar to the actual economic system of bonds and securities. Those are never physically moved the change of ownership is simply noted and stored safely.

The nature that the stones hold has been analyzed and discussed by Keynes (1883-1946) and Friedman (1912-2006). They considered it to be like the fiduciary system. It is a surprising analysis as fiduciary currencies are nearly never encountered in primitive societies. The Yap stones were used to illustrate those economist's theories and some fantasies/errors occurred along the way (Koning, 2013).

Keynes is exploring the possibility to have a currency that is represented instead of being a commodity. More precisely, he is studying the use a currency has no intrinsic value but a worth according to the actual state of law. Indeed, gold was not used as coins anymore and even banks were reluctant to move the precious metal. Instead, the financial institutions just ear-marked it. In the exact same way that the Yap stones were not moved. In fact, Keynes' analysis was inaccurate as the stones were sometimes moved (Koning, 2013).

James Tobin (1918-2002) emphasized Keynes' argument as even when the Yap island got under a flood and the stones were nowhere to be seen, the villagers still trusted their worth exactly like in the bank fiduciary system. It seems that Tobin was mistaken as well as no great flood was ever mentioned but it still did its work to illustrate the parallel (Koning, 2013).

3.1.4. Aztec and Cacao Beans

Since 1500 BC, the growing of cacao beans was major in Mesoamerica (area going from actual Mexico to Costa Rica). Most plantations were located in the lower and humid part of the

regions of Mexico Gulf. From there the cacao beans were transported to the uppers part of the Guatemalteque where it could be cultivated (Paradis, 1979).

The cacao tree was called *cacaohoaquahuitl* and was described as being a little bigger than an apple tree. Its fruits have a shape similar to a melon and called the *cacahoacentli*. The beans inside of the fruit was called *cacahoatl* that were used as a currency and as a beverage. The beans were described as tender, fleshly and slightly bitter. The fruit was also either cold and moist or tempered (Hernandez quoted in Louise Paradis, 1979, p.183).

According to Hernandez (1959), four types of cacao trees have been described as well as the different beans. The beans of the smallest tree - *xochicacahoatl* - were used for the beverages as they were smaller and therefore worthless as a currency. Indeed, the dimensions and quality of the beans had huge importance for the trades (Hernandez in Paradis, 1979, p.183).

Inhabitants used mainly barter to trade and had no fixed units, but some goods could be used to buy anything such as feathers, gold, jewelry. But the most used was cacao beans. Nearly every good could be bought with this evergreen plant. For instance, in Nicaragua, you can buy gold, slaves, clothing, food with it (Oviedo in Paradis, 1979, p.185).

A vicesimal system was put into place to measure and weight the beans. For instance, 400 beans were called a zontle and twenty of those are called xiquip and so on. This biggest amount went to 30 kilograms maximum in other words what a man can carry (Louise Paradis, 1979).

3.2. Institutionalized Currency

Along history, the right to produce the currency has been acquired by the power in place (monarchy, states, empires) in other words this has become a sovereign right. The coins were one of the first types of institutionalized currency. We will explore in this section, some of the early coins that have been used in human history.

3.2.1. Salt

Salt has been used for the taxes since Antiquity. In the ancient world, exploitation and consumption of salt were already a source of tax revenue, thanks to which the Roman legionnaires were getting their salary in salt. It was called the *salarium* which evolved into the word "salary". The state appropriated to itself the production for its distribution as it was a

source of value. This monopoly was a response to the dual concern of providing the public treasury with tax revenues and organizing regular supplies for the benefit of the population. Back at that time, the state was obliged to intervene, because salt, rather than bread, was a product of first necessity, indispensable and not substitutable. Indeed, it allowed keeping food fresh and eatable. The State, concerned with the public good, took under its control the question of salt (Encyclopedia Universalis, n.d.).

Salt has kept a significant role throughout history, the proof is the numerous kings that made a tremendous effort to apply a taxation system on the salt. In France, the King Philip IV managed to introduce a tax of this nature, the famous, or rather the frightening "gabelle" (in 1341 and 1343). As in today, those who own the precious taxable item found ingenious techniques to avoid the taxes. This is why numerous chairs in French castles have hidden compartments. A servant was sitting on the chairs next to the fire to protect this treasure from the king's unexpected inspections and from humidity (Encyclopaedia Universalis, n.d.).

Later in history during the 19th century, Belgian colonials came across a Congolese civilization that used salt bars intensively as currency. Even after the introduction of the Belgian franc in 1887, salt has not stopped circulating as many Congolese remained attached to ancestral currencies. To protect the salt bars, the Congolese used a special technique, they wrapped the salt in banana leaves leaving the ends open so as to control the authenticity of the bar by licking the salt. Just as we protect our euros with watermarks and holograms, the Congolese used this system to control their currencies. These salt bars had different names depending on the language of the manufacturer for example dibanga or dibanda. As for the cowry shells, the value of the salt varied according to the time, the place, and of course, the distance compared to the mines (or the sea), the production costs, etc (Banque National de Belgique, n.d.).

Figure 5: Ethiopian salt bar (700-900g/ 20-25cm) still in use today (Banque National de Belgique, n.d., para. 10)

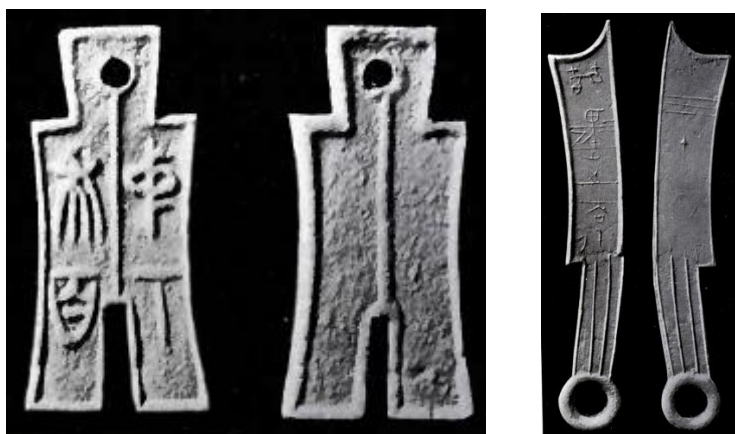


In his book *“La Production des grands hommes”* the anthropologist Maurice Godelier has studied the Baruyas tribe in New-Guinea. The tribe has been lately discovered in 1951. Godelier also discovered that they used salt bars as a currency just as in Congo and Ethiopia. To produce those bars, the entirety of the tribe was mobilized which helped to create social connections through the group. The salt is used for ceremonies and also to trade with other tribes in order to get weapons, agriculture tools, ... The salt is only used to get necessary goods and nothing dispensable. The anthropologist explains that the production of the salt bars is defining the relations between the tribe’s individuals. Indeed, the whole group is gathering around the production (Loraux, 1983).

3.2.2. First Coins in China

Twelve centuries BC the Chinese government wanted to simplify barter. The idea was to represent objects that were traded in a smaller size but in their own shape. Those representations were in metal and in the form of currency. The two main types of currencies that appeared were the *“pu”* that had a *“shirt”* shape and the *“tao”* that has a knife shape (See below). These two figures are thought to date from the 700 BC (Lord Avebury, 1902). See below two pictures of the *“pu”* and the *“tao”*:

Figure 6 & 7: The “pu” & the “tao” (Lord Avebury, 1902, p.6)



Those coins-to-be were not convenient due to their shapes. This is why the tao was shortened through time, the blades disappeared (Figure 8) followed by the handles (Figure 9) in about 200 BC. The holes in the coins were kept allowing to carry them with a rope. The round shape of the coins worked with the Chinese view that something that “rolls around the world” should be round itself (Lord Avebury, 1902).

Figure 8 & 9: The “tao” becomes a coin (Lord Avebury, 1902, p.6)



This shows in the case of China how the transition between objects and coins was smoothly operated (Lord Avebury, 1902).

3.2.3. Middle East currencies during the 3 millenniums BC

In the Middle East, three thousand years BC, silver was used as well as lead, copper, tin, bronze, and gold. In Mesopotamia, two thousand years BC the "red" gold (alloyed with at least one other metal) is exchanged against silver at the proportion of 8 for 1 and the "shining" gold (which could be electrum) is exchanged against silver at 4 to 1 (Doyen, 2018).

In the first millennium BC under various empires - such as the Neo-assyrian and Neo-babylonian - weighted silver (but not stamped) is the main mean used for trades. It is used to hoard value in various shapes (gross pieces, ingots, rods in one or multiple pieces, spiraled loops and other shaped objects). The referential weighing system differs between regions, but they are all based on the "talent" which is equivalent to what a man can carry without trouble (between 25 and 30 kilos). This is a similar rule to the cacao beans used as a currency. Each talent is divided into 60 mines weighing between 400-500 grams and each mine is divided itself into 40/50/60 sheqels (7 to 12 grams) (Doyen, 2018).

The first traces of the use of coins appeared 7th centuries BC in Lydia (actual regions of Turkey). In the beginning, the coins had a bean shape, were made of silver or gold and were struck up by a king named Gygès. Afterwards, coins were being minted in Greece and became currently used in Italy and minor Asia one century later. The coins were very handy as they contained a precise amount of precious metals so no need to weight them to trade only to count them. Moreover, they were easy to identify, to carry and to divide (Doyen, 2018).

3.2.3.1. Electrum Currency (600 BC)

The most frequent type of electrum encountered are the stater, the half stater, the third stater, [...], going down to 1/96. Usually, each coin has one side being stamped and a striped or smooth side (Doyen, 2018).

Figure 10: Electrum coins (Doyen, 2018, p.12)



See above in the first row the staters and in the second row going from left to right a half stater, a third stater and a $\frac{1}{6}$ (Doyen, 2018).

3.2.3.2. Cresus & Darius Coins

The electrum currencies have first used the reign of Cresus (B.C. 568-554), a king recognized because of its wealth. Electrum (shining gold) is an artificial alloy of silver and gold with a steady 54 percent proportion of gold. In order to obtain this proportion, it is necessary to add silver to the initial electrum which has a high concentration in gold but unstable (going from 65 to 85 percent). The coins hold a bull and lion on one side and two concave squares on the other (Figure 11) (Doyen, 2018).

Figure 11: Electrum coins Cresus & Darius (Doyen, 2018, p.13)



Later in history, different coins came alive under the king Darius (BC 521-485) and represented him holding a bow and arrow (See below). (Doyen, 2018)

Figure 12: Electrum coins Darique (Doyen, 2018, p.15)



3.3. Conclusion

All the objects that we have described here hold intrinsic value. Either as a utility (ex: salt, cacao beans, etc.) or as a symbol (the Yap stone) or as wealth (precious metals). Some of the worth of those objects are calculated according to the number of hours it takes to create the object (ex: wapums), following the way to calculate of Adam Smith's division of labor. Nearly all these objects also have the same characteristics to be small, easy to carry, solid and lasting in time (except for the Yap Stones, of course).

In the next section, we will study the notes which don't have an intrinsic value but that are supposed to represent the value of the wealth stored in the banks. The big inventor of this representation idea is John Law.

4. The Notes

Once the monetary system was quite installed, notes appeared along with the coins. For different reasons such as the effectiveness of the weight and the fact that the resources of metal are not endless. Indeed, the number of trades has increased so much that there were not enough metal to cover all the transactions so paper money was created instead. The notes were made of a far less valuable material such as skin and paper which were available in endless quantities (Le journal d'Hugot, 2017).

4.1. First Notes in China

According to some historians, the first traces of leather money were found around a hundred years BC. It seems that this trend developed until the 15th century. Chinese were the first to develop the bank notes in the 7th century. It appeared under the Tang Dynasty and had the aim to serve trades. Indeed, the merchants did not want to have to carry heavy bags of coins for big transactions. The shape evolved, and it became real paper notes in the 11th century under the Song dynasty (Goetzmann and al., 2005).

Coins, circular with a rectangular hole in the center as described previously, were already used broadly in the empire. When the number of coins became too heavy to be carried, merchants could deposit it and leave with a piece of paper. This was the first form of promises/notes as seen in the bank system later in history. Those promises became the paper notes used in the 11th century (Bowman, 2000).

The coins and the notes were circulating simultaneously in the late 10th century. The merchants, while making a credit note, saw a tax operated on their deposit. Moreover, the deposit was valid for a limited amount of time. Many advantages came along with the use of notes. The central government instituted a monopoly on the deposit shops which of course revealed itself to be very lucrative. By the 12th century, the government issued official paper notes (J. Bowman, 2000).

4.2. First Notes in Europe: a Swedish Invention

Since the 17th century, metal currency was already used and consisted of a 20 kg copper plaque and measured 30 cm x 70 cm. Each plaque was worth 10 *dalers* (Swedish currency). As they were so heavy to carry, a first system of “paper-currency” came to life. But only to recognize

the deposit (with no interest) and the debts. Swedish people would go around with those papers to trade (Hewitt & British Museum, 1995).

Figure 13: Copper plaque (Banque National de Belgique, n.d., para. 1)



The Swedish economic situation was not great in the 17th century. The queen Christina emptied the royal treasures with her 30 years war (1618-1648) and her successor Karl X Gustave worsened the situation by going in wars with Poland and Denmark (Hewitt & British Museum, 1995).

In these unfavorable economic times, in 1656, Johan Palmstruch (1611-1671) was asked to create the first Swedish Bank the “*Stockholm Banco*”. The bank was officially private but was de facto public and working very closely with the public institutions. For instance, half of the bank’s benefit went back to the state and the customs were transiting through the Stockholm Banco (Hewitt & British Museum, 1995).

Each transaction required tons of transfer of copper this is why the Stockholm Bank created in 1661 the first European notes. The notes were made with a thick white paper containing the stamp of the bank, the required signatures and the word Banco in watermark (Hewitt & British Museum, 1995).

Figure 14 & 15: First Swedish “Notes” (Banque National de Belgique, n.d., para 15)



Those notes had a unique number handwritten and were signed by the head of the banks. The bank stamp had to appear in three various places twice between the signatures and once in front of the notes number (Hewitt & British Museum, 1995).

As explained before, many Swedish citizens had deposited their copper plaques in exchange for “paper currency” and the system was functional. But in 1660, copper (the plaques) lost 17% of its value compared to the *daler* made of silver. Which had as an effect that the new plaque made were smaller than before. The predictable reaction of the clients was that they asked the Banco bank to return their plaque so that they could sell it for the metal price. Johan Palmstruch was afraid for the bank’s stability. He received the authorization to produce credit notes to cope with the issue (Hewitt & British Museum, 1995). Those notes had officially no value, but the citizens were able to pay the taxes with it which means that it had a legal tender status.

Johan Palmstruch made a place for himself in history by creating the first note in the modern way to comprehend it. Paper with a fixed amount written on it with no reference to a deposit nor interest and payable in demand. Owning such a note signified a receivable from the bank and was guaranteed by the first form of the central bank (Hewitt & British Museum, 1995).

4.3. First Notes in France and the Inflation

4.3.1. John Law: the Premise of Modern Capitalism

A few years ago the bank system nearly collapsed due to the financial crisis of 2008. Unleashed speculations, way too high risks lead to a hit that all developed economies have felt. But this was not the first time that such a crisis occurred. In France, in 1720, under the monarchy that the monetary system collapsed under the bankruptcy of Law (EduBourse, 2014).

In 1715, the Kingdom of France is highly in debt because of all the wars being conducted. The state-owned ten times the annual financial income. This burden is a legacy of Louis XIV and his successor (Louis XV) being only five there is little hope that a solution would occur from the throne itself. The kingdom is put under the regency of Philippe d’Orleans until the majority of the king (EduBourse, 2014).

The regent decides to entrust the sanitation of the debt to John Law (1671-1729), a Scottish economist being on French ground since 1714. John Law has many skills and has studied the

financial system in Amsterdam among other places during its many travels in Europe (La Libre, 2010). The man is a visionary and is given the power to redo the French monetary and financial system. The economist will base all his decisions on a strong assumption: Currency is not wealth but a mean for trades. His economic theories are described in his book “Money and Trade Considered, with a Proposal for Supplying the Nation with Money” (La Libre, 2010). He is strongly convinced that coins are a limitation in the trades between countries as their transportation is made difficult by their weight. John Law operates a demonetization of the precious metals and operates the apparition of the use of paper currency that will be exchangeable to the banks for gold and could be accepted by anybody. This paper currency can also be used to pay the taxes (giving it a legal tender status) (CultureBanque, 2013). This system is a revolution at the time but very usual nowadays (EduBourse, 2014).

Figure 16: French Note (CultureBanque, 2013, para. 7)



Philippe d'Orleans gave the power to John Law to create a private bank in 1716, the General Bank (that became the Royal Bank two years later). The Bank had such a success that it was soon able to lend the precious metals to the French state (CultureBanque, 2013). Soon the French state asked the Bank to exploit the colonies through the Compagnie d'Occident (1718) created by John Law himself. The bank invests in various projects such as the 'la compagnie du Mississipi', the equity of which were sold by the Bank ("L'inflation en France: l'épisode de John Law et les assignats", 2011). After two years of existence, the Bank became powerful enough to welcome foreign capitals. Meaning that the paper currency did not only show the solvability of the bank but the trust of foreign states in the French financial power. Philippe d'Orleans is in awe seeing the success of John Law and nominate him general auditor of the finance. Through radical decisions, John Law forces French citizen to not hold too much precious metals and forces them to convert it into paper currency (EduBourse, 2014).

The Law system is fragile, and speculation is raging due among other things to the fact that more paper currency was produced than the real ownership of precious metals of the bank. La Libre, 2010). The price of the paper currency is skyrocketing. The paper currency as well as the project of the colonies (such as the Mississippi Bubble) exploded at the same time and the value of the paper money collapsed. Panic was on board. In a few months, all the paper currency and equity held by everybody in the country were worth nothing. The banking situation was so bad that a common insult became “banker”. The panic started within the inner circle around the King and spread in 3 or 4 days to the people. The panic led to a riot in front of the bank in the street Qimcamboix. The people wanted to exchange their paper currency to get the precious metals back. For the obvious reason that the value of the paper currency is only a promise (that could not be trusted anymore) while the metals had an intrinsic value ("L'inflation en France: l'épisode de John Law et les assignats", 2011). Similar situations appeared along with history in case of panics in the banking world.

John Law fled the country in 1720. His failure has prevented the French kingdom to fix its financial system for many years, unable to overcome such a trauma (EduBourse, 2014).

As a legacy of this failure, essential prudential regulations for a safe functioning of the banking activity have appeared among the bankers of the Haute Banque of the XIX century. They are convinced that their strength holds in strong equity that rises the trust of their clients and allows the bank to benefit from deposits. Those deposits are invested to develop industries and commerce (CultureBanque, 2013).

4.3.2. French Revolutions and Assignat

At the end of the ancient regime in 1789, France encounters a new major financial crisis. The population is starving, and the country's debt is tremendous. Overall, the country is near bankruptcy when the French revolution strikes. It is in this awful economic situation that the assignat came to life (Banque Nationale de Belgique, 2012).

The king Louis XVI gathers all the leaders of the country in order to find a solution to the debt and the crisis in general. The outcome was to abolish the old system in which stood too many unfair and heavy taxes. The latest were feeding the revolution spirits (Banque Nationale de Belgique, 2012).

An idea of the deputy Charles Maurice de Talleyrand stands out: nationalize the clergy's goods. Those were mainly buildings or agricultural properties. The idea is accepted, and the church confiscated goods are up for sales but in an extremely specific manner: the assignat. The idea is that the people wanting to purchase the church's goods are only allowed to do it through assignats. They must go to the state to buy assignats beforehand. Those assignats are close to bonds issued by the treasury. Their values are assigned on the church's belongings and allows the state to have liquidities coming in with no delays thanks to the loans of the citizens without having to wait for the goods to be actually sold. At this point the interest on the bonds were 5 percent (NumisCorner, 2017).

Figure 17: Assignats 1 (NumisCorner, 2017, para. 10)



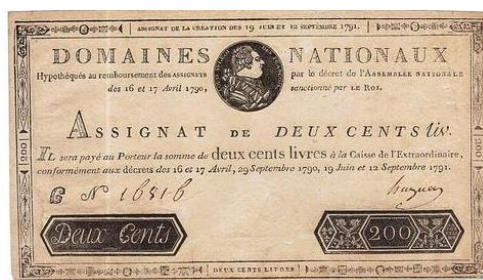
The production of the assignats starts in December 1789, an extraordinary treasury is created and in charge of creating the bonds and to collect the cash coming in from the sales. The first emission was made for 400 million pounds in high denomination (from 200 to 1000) in order to make it difficult to use them for any other transactions. Once the transaction operated the assignats had to be destroyed by the state. The existence of those bonds is a subject of political discussion. Many members of the political world are afraid of a collapse (NumisCorner, 2017).

In 1790, the state despite the first emission of the assignat is still in lack of liquidities and decides to diminish the interest from 5 to 3 and finally to 0 percent. This is how the assignat became a paper money. Simultaneously, the state does not destroy the used assignats anymore and print additional paper currency. The state forces the merchants to accept the paper money and forbid for it to be exchanged against precious metals. During the all terror Reign (1793-1794) the assignats are the only recognized legal tender (NumisCorner, 2017).

The counterfeits:

France has to cope with a new challenge: the counterfeits of the paper money. Various countries (England, Germany and Switzerland) are producing forgeries to hurt France's financial credibility. The counterfeits were coming in the French economy from everywhere. Some copies of the assignats are poorly made but some other are so good that they are impossible to distinguish from the real ones (Banque Nationale de Belgique, 2012).

Figure 18: Counterfeit (NumisCorner, 2017, para. 26)



The state is trying to fight the forgeries of course by using different means such as specific printing or secret parameters but it is not enough to cope with the dissemination of the counterfeits. One of the main reasons of this failure is the lack of efficient information held by the public concerning the ways to distinguish the real and the fake assignats (NumisCorner, 2017).

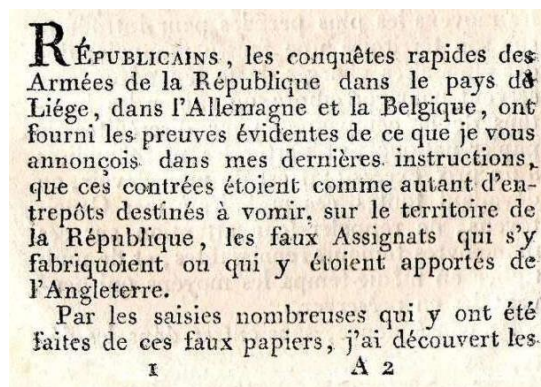
The attempts to inform the public had more negative than positive impact as explained by E. Levasseur:

“Attempts were made to safeguard the public against the frauds. A number of pamphlets were published detailing ways of distinguishing the genuine articles from the counterfeit assignats, but they did little to re-establish trust, fueling instead the panic, as they showcased the wrongdoing and people never ceased talking about verification, stamps, and cancellation.” (E. Lavasseur, 1894 quoted in The French Revolution, The Assignats, And The Counterfeiters)

The state to try to fight the counterfeits is issuing new regulations as fast as they were printing the paper money. Here below an example of the laws taken by the governments against the

forgers addressed to the republicans about forgeries in Belgium and Germany (Catalogue Général des assignats français, n.d.).

Figure 19: Laws against the counterfeits ((Catalogue Général des assignats français, n.d.)



In 1792, the French state has to print even more to cope with the expenses of a new war with Austria. Of course, this increase of the units of the paper money (with the legal printing and the counterfeits) have led France in a hyperventilation crisis. In three years (1790-1793), the worth of the paper money drops by 60%. The monetary mass was multiplied by 20 during the revolution, the church goods don't guarantee their value anymore and so the paper money is hit by an even bigger depreciation. In 1796, the worth of all assignats was 45 billion pounds for a actual worth (of the clergy's belongings) of 2 to 3 billion. The paper money obviously became worthless in this context of inflation (Banque Nationale de Belgique, 2012).

In 1796, the assignats is officially abolished only 6 years after its birth. Some positive side came from the assignats. Indeed, the revolutionaries were able to overcome the deficit left by the King Louis XVI and to have the finance to go to war against the royalist not long after. The assignats will be replaced by the *mandat territorial* that will disappear even faster (NumisCorner, 2017).

Figure 20: Mandat territorial (NumisCorner, 2017, para. 30)



After those dramatic episodes of inflation and crisis, the currency came back to the use of precious metals (NumisCorner, 2017).

4.4. Conclusion

These last illustrations show how careful a state must be towards its financial policy especially in hope to get out of a crisis. As shown above the risks of counterfeits is an additional parameter that the governments have to deal with.

John Law created the idea that the citizens could hold a representation of the money rather than the money itself. Nowadays, currency isn't guaranteed by anything, but the trust given to the state producing it. In the fact that it will keep having the same value in the future. Currencies don't hold any worth in itself anymore but only represent it. This representation status is only sustainable thanks to the individual units of trust that individuals put into the power producing the currency (Bruno Colmant, 2017).

In the case of cryptocurrencies, the system is protected from such fraud as with the system of blockchains for instance the traceability of the money is complete and flawless. Also, in the case of the bitcoins their number is finite which allows them to stay out of inflation as no leaders can print new ones. We will keep this in mind (linked to the quantity theory of Irving Fisher) when trying to understand if it is logical for a state to use cryptocurrencies to achieve the most efficient and profitable economic system.

5. Banking System

We will study in this section the apparition of the Bank of Napoleon. Then we will see how the Latin union (“precursor” of the Eurozone) was build and why it failed. We will study how the gold standard (and gold exchange standard) was used and why it was abandoned in the early seventies leading to a system where money is not guaranteed by gold anymore: the fiduciary system.

5.1. Central Bank under the First Consul

On the 18th of January 1800, Napoleon Bonaparte created the Bank of France. This decision was made right after that the first consul reached power under the advice of Jean-Frederic Perregaux. As said above, after the huge failure of the assignats, it was decided to go back to the metal coins and to definitely destroy the *planche à billet of the assignat* (Lyons, 1994).

We are under a new regime called the *Directoire* willing to signify the end of the terror and the revolution. In this new era, trades are starting again, and the lack of money is being felt (Herodote.net, n.d.).

Jean-Frédéric Perregaux creates the *caisse des Comptes courants* and asks to Napoleon with a group of bankers the permission to start printing notes again. Printing those would allow to collect the savings and increase the quantity of money in circulation. Later on, the *Bank of France* is created and absorbs the *caisse des Comptes courant*. The bank obtains the right to print notes but with prudence and limitation. First, the system was only allowed in Paris and under the condition that anyone coming to the bank with a note could exchange at any moment its worth in gold. This will help the French to trust the notes again and the paper money will slowly take over on the precious metals. The first notes are printed with black ink on one of the sides of a white watermarked paper (Contrepoints, 2015).

Napoleon Bonaparte while talking about the Bank of France always referred to it as “my bank”. He did not only mean that he was one of the initiators but that he would use it as a tool for power. He was, with his inner circle, the main shareholders of the bank (Contrepoints, 2015). See in the paragraph below the list of the subscribers of the bank (Contrepoints, 2015):

“Bonaparte, First Consul, 30 shares ; come afterwards and in this order, his intimates, his parents, the officers of his staff, his financial advisers, then the founding bankers: Bourienne, 5 shares ; Clarke, 1 share [...] ; Joseph Bonaparte, 1 share” (Flour de Saint Genis quoted in Contrepoints, 2015)

In order to be able to pay back the clients, the bank is provided with 30 million francs (a very high amount for the time). This capital is given by bourgeois such as Jean-Frederic Perregaux and Napoleon himself invest in the bank to show that this new bank is trustworthy. In exchange of those investments, the shareholders have the right to nominate the director of the Bank (Contrepoints, 2015).

After the hard times of the revolution, the Bank of France will help the country to get back on its feet. It will encourage the industry by facilitating the borrowings and increase the quantity of money in the system. Many French will earn more money and therefore will have to pay more money to the state which will allow the first consul to finance new wars against other European countries (Contrepoints, 2015).

The first year of the bank of France will be harsh as many clients will doubt the value of the notes and ask for the gold in exchange. To overcome this situation, the first consul will increase its authority on the bank by giving its direction to governors and sub-governor assigned by Napoleon himself. From this point, the shareholders of the bank will not have the power to elect the direction of the Bank anymore and lose their voting power over it. In 1848, the fact to exchange the notes for the gold will be forbidden but the citizens trust the system enough for it to sustain despite this interdiction. This central bank will hold for a tremendously long time in history (Herodote.net, n.d.).

5.2. Monetary Union

5.2.1 The Germinal Franc

After the French revolution, Napoleon the 1st has the will to build a unified and simple of use monetary system. In 1793, the national convention (the assembly governing France from 1792 until 1795) imposed a decimal system (based on decade) in France. In 1795, the convention adopts a new monetary unit called the silver franc (the “franc argent”) that following the decade system can be divided in 10 part that are all worth 10 cents. The silver Franc was nine units of

pure silver and one of alloy (corresponding to 4,5 gram of silver) (Gouvernement de la République française, n.d.).

Despite the decision of the convention, the silver franc was not issued right away because of the lack of precious metal itself. The lack of issuance of the announced new currency led to a quite anarchic situation. Ancient currency was used, foreign currencies were all being used in the economy at once (Gouvernement de la République française, n.d.).

It is in 1803 that the consulate (the government under Napoleon) with the *loi du 7 germinal an XI* of the 27th March 1803, was able to mint the first coin called the germinal franc (the “franc germinal”). The franc bears the effigy of the consul on one side and the sentence *Republique française* on the other. With this law, it is established to mint six types silver coins and two types gold coins. With the currency being defined by a fixed weight of precious metals, the fusion is made between the currency of amount and the real currency. The state is for now on simply certifying the currency (Gouvernement de la République française, n.d.).

Figure 21: Franc Germinal (Université de Poitiers, n.d.)



Concerning the germinal franc, the law states that silver is now part of the francs and gold is subordinated to it. The rate between gold and silver is of 15,5 (one unit of gold is 15,5 units of silver, or in other words 4,5 grams of gold for 0,29 grams of silver) (Université de Poitiers, n.d.). For the fabrication of the machines needed to mint the coins, Michel Gaudin (Napoleon’s finance minister) asked to melt canons seized during battles. This rate was used while ancient canons were melted in 1785 in order to make new coins. The melted machines will serve during a hundred and fifty years (Gouvernement de la République française, n.d.).

Napoleon the 1st introduces and makes effort for this system of bimetallism to be adopted by other countries in Europe. The system is adopted in 1832 by Belgium, in 1850 by Switzerland and in 1862 by the young republic of Italy (Gouvernement de la République française, n.d.).

After creating the Germinal Frank and the Bank of France, as explained above, Napoleon Bonaparte strongly encouraged the countries being under the French influence to adopt a monetary system based on the Napoleon, coin of 20 francs (Gouvernement de la République française, n.d.).

He wrote to his brother Louis (King of Holland and father of the future Napoleon the third) in 1806:

“My brother, if you desire to make new coinage, I wish for you to adopt the same valuable divisions as in the French coins, and that your coins bear, on the one hand, your effigy, and on the other, the weapons of your kingdom. In this way, there will be uniformity of currency throughout Europe, which will be of great benefit to trade.”
(Napoleon quoted in Herodote.net, 2018, para 5.)

After the battle of Waterloo and the collapse of the Napoleonic empire, the Napoleon as coinage was abandoned for sometimes (Gouvernement de la République française, n.d.). Later on, several countries (Belgium, Italy and France) decided to go back to this easy system of equivalence between the coinage in order to build a strong monetary system. This will and the agreement that followed gave birth to the Latin Monetary Union (Einaudi, 2018)..

5.2.2. The Latin Union

The monetary convention of 1865 gave birth to the Latin union. This union was a monetary system based on the bimetallism of the gold and silver. In December 1865, Belgium (ruled by Leopold the second), France (ruled by Napoleon the third) and Italy (ruled by Victor-Emmanuel II) and Switzerland signed the monetary union, the ancestor of the Eurozone (Herodote.net, n.d.).

It was based on the same principle than the Germinal franc. The idea is that all the currencies of the different countries have the same weight in thin gold while keeping their own name and their national stamp. The different currencies and their main subdivisions can be used in all those countries. To make transactions in France with Italian coinage, for instance (Herodote.net, n.d.).

The 1865 convention gives the freedom to the members to leave the union as they wish. For this reason, many countries join the union such as Greece as soon as in 1868. Thirty-two countries will be part of the union going from Argentina to Finland at the exception of England and Germany (Gouvernement de la République française, n.d.).

Figure 22: Propaganda image for the Latin union (1900) (Herodote.net, n.d.)



The union accepts along the gold and silver coinage. The fact to base a union on two precious metals will hurt the union. The Californian and then Australian (National Museum of Australia, n.d.) gold rushes will lower the value of gold (Einaudi, 2018). Consequently, silver gains in value.

According to the legislation applying at the time, anybody could bring gold and silver to have it mint. In the decade of 1860, with the incoming gold, the value of this precious metal was strongly depreciated (Einaudi, 2018). By the law of Gresham, silver slowly but surely was driven out of the market (Colmant, 2017).

The Gresham law goes as follow: the most important function of a currency is its hoarding. Indeed, it shows the trust that one can have in its future worth and the purchasing power coming along with it. If the currency is felt like unreliable, the folks will use it in order to obtain more trustworthy goods. Those more reliable goods will become itself the new currency (Roncaglia, 2006).

In this specific case, the application of this law was shown considering the bimetallism where gold and silver were used. When two different currencies are used simultaneously in the same

system the bad currency will chase the good away. Indeed, people will use the bad currency to buy in order to get rid of it and will hoard on the good currency in order to be able to use it later on. This also shows that the trust that a currency holds stands into its deepness in the future (Colmant, 2017).

The Latin union has worked wonderfully for many decades and has increased the feeling to belong to a common culture and continent. An extremely high level of integration was reached by the end of the nineteenth century (Gouvernement de la République française, N.d.). The union was also hurt by different political interests, a lack of stability and the tendency of the state not take into account the union's interest (Fendel & Maurer, 2015).

5.3. Gold Standard System

After the issues of the double standard (silver and gold) bimetallism system, a new system was thinking by the countries to stabilize and facilitate the trades (Flandreau, Leeming & Oxford University Press, 2004). The system established was the gold standard system, that worked extremely well from 1879 until 1914. Indeed, the system will not survive the trauma of the first world war. It was so successful in fact that it was decided after WWI to reestablish this system, but with a minor success (Einaudi, 2018).

This system was not flawless. A first default is that not all countries have the same amount of gold mines. Another dimension is that the economy was based on a fixed amount of gold and thus the money amount was limited. As the prices of goods and services evolve really slowly, the conjunctural adjustments are made by other ways. High rate unemployment in depression and too small capacity of production in economic growth (Université de Renne, n.d.).

One of the reasons explaining this great success was that there was an automatic adjustment mechanism. Meaning that there was a free-trade in gold (or in currencies based on gold), in other words in capital. And that by the Hume mechanism (as explained earlier in this thesis), the exchange rate between the currencies would adjust automatically (Université de Renne, n.d.).

David Hume explains that the countries' economies equilibrate constantly. Indeed, if a country has positive in trade (meaning that they have more exportation than importation) it owns more

gold and therefore can print more notes. As it prints more notes it causes the prices to go up and therefore the country is less attractive. In the opposite situation, a country in deficit (having more imports than exports) the prices go down and the country gets more competitive (Université de Renne, n.d.).

5.3.1. The Gold Standard: Automatic Adjustment

The success of the gold standard was made part of the automatic adjustment (David Hume theory) coming from the national and international economic conditions. This system far from perfect was a regime based on fixed exchange rate (Université de Renne, n.d.).

Example of Hume's system (Université de Renne, n.d.) :

1. USA: 35 dollars for one ounce of gold
2. France: 210 French Francs for one ounce of gold

The parity in the two currency is therefore 6 French Franc for 1 dollar ($\frac{210}{35} = 6$).

The exchange rate changes to 6,2 (Frank for a dollar) then it makes sense to buy some gold with Franks then go exchange the precious metal for dollar and finally exchange those dollars for some francs making a benefit of 3,33% (Université de Renne, n.d.).

$$\frac{1}{210} * 35 * 6.2 = 1.0333 \rightarrow 3.33 \%$$

To work, the gold standard stands on a free exchange of gold and capital internationally. This phenomena of automatic adjustment of the payments balance is known as the Hume mechanism. As seen above, when a country has a commercial deficit (more imports than exports) it loses gold to the benefit of its competitors which shrinks its currency offer and increases the rest of the world. Moreover, as said before, less money reduces the domestic prices and increases its international competitiveness meaning that the country gets back its commercial equilibrium (Université de Renne, n.d.).

The limit of the automatic adjustment:

For this adjustment to be indeed automatically guaranteed by the golden standard, each country has to perfectly respect the equivalence between the gold and the currency and has a perfect freedom of movement in the capitals. Of course, to fight against the unemployment and economic growth many countries diverged from the rule to help their own economy. Moreover, the country owning the economic dominance was Great-Britain which gave the sterling the position of reserve currency (Université de Renne, n.d.).

Before 1914, Great Britain was extremely independent in its financial politics because extremely powerful. The country was huge creditor of other countries and the sterling was often the reserve currency of the other central banks. Therefore, the English bank was determining the interest rate for all countries according to the British conjuncture which of course did not fit the other European countries. As in many other cases in history (some showed earlier in this work), the English bank stopped following the obligatory equality between the notes and the gold (the gold only covered between 30 and 50 % of the notes and coinage issued). Other countries did not hesitate to act in the same way by guaranteeing the number of notes by other currencies held in the Bank instead of gold. The role of Great Britain as an international currency remains modest compared to the one of the dollars after the second world war. (Université de Rennes, n.d.).

5.3.2. The Gold Standard from 1914 until 1939

We will briefly describe the evolution of the gold standard from the beginning of the first world war until the end of the second one before speaking about Bretton Woods.

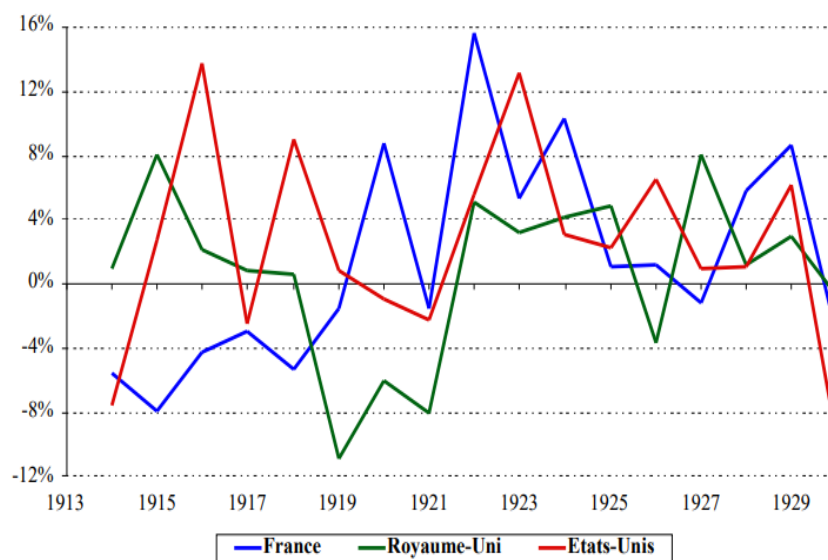
5.3.2.1. 1919-1926: Free Floating

As explained earlier in this thesis, during wars, countries tend to print as much money as they need to finance the war without any control. This leads to tremendous inflation that have to be dealt with after the war. After the first world war, the main concern of European countries was to cope with the striking inflation occurring because of four years of conflict and reconstruction. The inflation diverged depending on the different countries and was higher in Europe than in the US (Université de Rennes, n.d.).

European currencies began to free float. The different European countries under the impulsion of Great Britain tried to find an agreement to restore the monetary equilibrium during the Gena conference in 1922. Thirty-four countries met and agreed to go back to the Gold exchange standard but in a way that would spare the gold. Indeed, the “central” countries would keep their reserve in gold and other countries would keep their reserve partly in gold and partly in the currency of the “central” countries. This allows to keep under control the price of the precious metal (Walrafen & Association d'économie financière, 1994). It took between 7 and 10 years for all the countries to go back to the gold standard. Once they were able to dominate this hyperinflation or hyper deflation depending on the country (Université de Rennes, n.d.).

The different countries dealt differently to fix their economies. Great Britain, for instance, applied a strong deflation policy going by pair with a strong austerity on the budget. The British economy was highly hurt on many ways. The GDP stayed still for around ten years from 1919 until 1930 while the American one was around 2% per year (Université de Renne, n.d.).

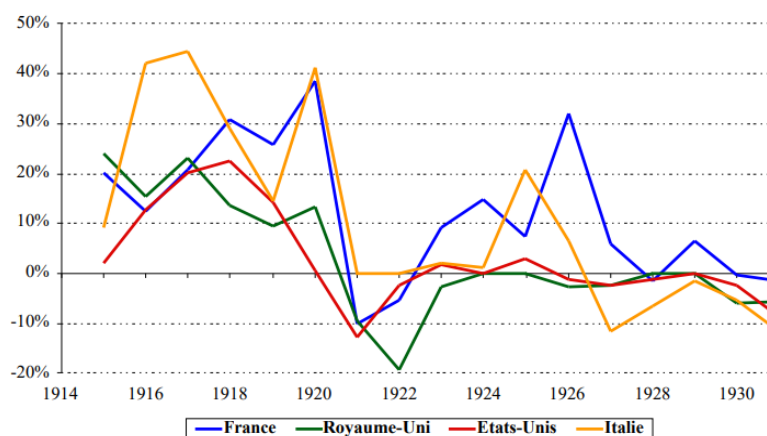
Figure 23: Real GDP ((Université de Renne, n.d., p.5)



After the first world war a real shift occurred concerning the previous “laissez-faire” (such as the automatic adjustment). The British government was highly criticized by Keynes as early as 1930. J. Keynes in its essay “The end of the laissez-faire” goes for the exact opposite of all the theories of Adam Smith. The system of free market is given up in Europe and the countries turn themselves to different options such as a regulated market, protectionism and State interventions. The first war shows a real division between the XIX and the XXth century (Berend, Nguyen & Servais, 2008).

About the other countries such as Germany, Switzerland and central Europe they joined the golden standard once they dealt for with their hyperinflation. Through their policy, their GDP and economy improved faster (up to 4% per year in France) than the British one during the same period and encountered less unemployment.

Figure 24 : Inflation rate (Université de Renne, n.d., p.4)



5.3.2.2. 1927-1931: Short Return to the Golden Exchange Standard

From 1927, the rebuilding of the golden standard exchange was completed and gathered most countries except the RUSS, China and Spain (Université de Renne, n.d.).

The system was not as strong as the one before the first world war for two main reasons: first, all countries abolished the possibility to convert notes for gold (by the common bank client) and that the use of gold as a currency for the day-to-day life was restricted and abolished. Because of these of these two phenomena, the Hume mechanism (equilibrium between the economies, explained above) disappeared. The Gena conference was supposed to coordinate the monetary policies between the different nations. And therefore, cope with the disappearance of the Hume mechanism. In this new system, the gold was convertible but only between central banks with a cover between the gold and the currency of 40% (Université de Renne, n.d.).

Sadly, this coordination did not pay off partly because of the non-involvement of the USA. Indeed, after WWI one the international economy was dictated by two poles: London and New-York. But none of these two economies were ready to subordinate their economy to deal with an international currency (Université de Renne, n.d.).

The pound sterling was overrated while the French and German currencies were under-valued. Therefore, these two countries kept a tight monetary policy to keep the countries to go back to inflation. To follow this policy, they exchanged their pound sterling for gold which increased

the French and German gold stock while the British stock shrieked. But as the Hume system did not apply anymore, the prices in Great Britain did not diminished linked to the decrease of notes due to the decrease of gold and therefore the economy of the country did not become more attractive. Great Britain stayed in deficit and France stayed positive balance (Université de Renne, n.d.).

The United states could have helped with the situation as they owned the biggest stock of gold in the world. If the country had set low interest it would have encouraged a distribution of the gold through the world, but the Federal reserve had in mind to set high rates to keep the cover of gold compared to the notes (Université de Renne, n.d.).

With the great depression in 1929, the British banks are losing all their gold stock meaning that the financial institution had way too much notes compared to its reserves. In 1931, the decision is made to forbid the conversion of gold and to let the pound free float again (Université de Renne, n.d.).

5.3.2.3. 1931-1949: The Managed Floating

The floating decision led to a sharp depreciation of the pound compared to the dollar. All countries holding large sterling balances, such as Norway or Denmark, witnessed huge depreciation of their own currency. The situation worsened in 1933 because of the USA. The US, the only country still using to the gold standard, put an embargo on their gold exports as well as putting into place control on the exchanges and depreciated the dollar against gold from 20,67 to 35 dollars ounce. What remained of the system broke out in 1935 with the devaluation of the Belgian franc, which provoked the bursting of the gold block formed in 1931 by France, Belgium, the Netherlands, Italy, Switzerland and the Poland to maintain gold parities and prevent competitive devaluations (Université de Renne, n.d.).

5.3.2.4. Conclusion

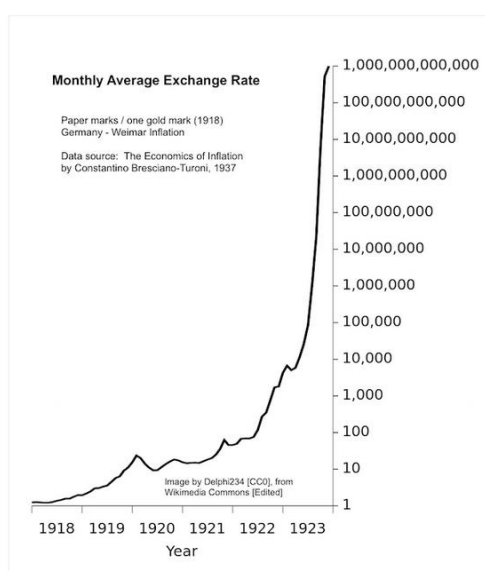
Before the first world war, as explained before, most countries used the gold standard system. But as the wars came along, they had to finance the combats and to print notes to afford those costs. Of course, this led to a hyperinflation. In some cases, as in Germany between the two wars under the Weimar republic, where the prices to buy a simple stamp increased through the roof reaching millions (see table below) (Soulié, n.d.).

Figure 25: Increase in the price of a stamp (Soulié, n.d., p.2)

25.12.22	15.1.23	1.3.23	1.7.23	1.8.23	24.8.23	1.9.23	20.9.23	1.10.23	10.10.23
80 Mk	150 Mk	300 Mk	800 Mk	3000 mk	60000 Mk	200000 Mk	750000 Mk	6 millions Mk	15 millions Mk
20.10.23	1.11.23	5.11.23	12.11.23	20.11.23	26.11.23	1.12.23	1.12.23	1.10.25	1.8.27
30 millions Mk	200 millions Mk	4 milliards Mk	40 milliards Mk	80 milliards Mk	320 milliards Mk	300 milliards Mk	30 Pf	25 Pf	25 Pf

More generally, the value of a gold mark in papier mark strikes up beyond common sense (Soulié, n.d.).

Figure 26: German inflation ("The nightmare German inflation", n.d., para. 41)



This is no surprise that in the in between of the wars most countries were wanting to go back to the gold standard system. As said above most countries managed pretty well until the great depression of 1929. After the crash, the public wanted to go to the banks to get gold in exchange of currency (Université de Renne, n.d.).

After all those episodes of great crisis and hard time most countries were more than happy to try to find a new system. This new system came up during the Bretton wood conference, gave more flexibility to the countries but not as volatile than a currency with no standard (Université de Renne, n.d.).

5.4. Bretton Woods (1944)

At the end of the second world war, a conference is organized in Bretton woods (New Hampshire, USA) with 44 allied nations in order to find a new financial system able to fix the instabilities that appeared since the end of the first world war. J. M. Keynes is one of the investigators of this agreement. The international monetary fund (IMF) and the World Bank (the international bank of reconstruction and development) were created during this conference. Those agreement will come to an end with the end of the convertibility gold-dollar by the president Nixon (Investopedia, 2019).

A switch is operated from the Gold standard to the Gold exchange standard meaning that gold is not the reference anymore, but the dollar is. This last currency is the only one allowed to be converted for gold (each ounce of gold is worth 35 dollars). This decision made sense as the USA owned $\frac{3}{4}$ of world gold and no other countries was able to afford their currency in gold. The system came fully into force in 1958. From this date, countries are able to pay their balance in dollars. By this decision, a new monetary system came to life that established the US as the first power in the economy of the world, as it was to only economy allowed to print dollars ("How a 1944 Agreement Created a New World Order", n.d.).

The backbone of the agreement meant that the different states did not engage themselves to cover their currency in gold but in dollar. Moreover, the central banks of all countries would keep their exchange rate stable compared to the dollar. To do so if the currency of a country became too weak, the central banks of this country would buy its own currency in foreign exchange markets to rise its price. In the opposite situation, if the national currency got too strong compared to the dollar, the state would print more to lower its price. This phenomenon is simply following the rule of supply and demand. The members also agreed on avoiding trade wars meaning not to influence their currencies to influence their trades. Of course, actions were allowed if direct investment from other currencies destabilized the national currency ("How a 1944 Agreement Created a New World Order", n.d.).

Obviously, this means that the US have huge responsibility in setting the price of gold in dollars in order to retain the trust in the future possible convertibility in gold. As our actual monetary system, its well-being holds in the trust in the financial institution about the future worth of the currency ("How a 1944 Agreement Created a New World Order", n.d.).

As the dollar was the new gold, its demand increased and its worth along with it. Of course, the worth of the dollar remained the same as it was linked to the amount of gold. This phenomenon led to the end of this system 30 years later. During the same period, the US have to deal with additional expenses and have to stay competitive in its economy. Indeed, Europe and Japan's industries are doing well and therefore challenging America. Also, with the cold war, the States have to invest tremendous amounts in military intervention ("How a 1944 Agreement Created a New World Order", n.d.).

To cope with those increasing expenses, the American state is printing more and more notes. Despite the responsibility of keeping the price of the gold still, the printing machine is going. And as the foreigners do not have a clue, the dollar bills are being spent with still the same (biased) golden exchange rate (35 \$ ↔ 1 ounce) ("How a 1944 Agreement Created a New World Order", n.d.).

Soon enough, the stock of gold does not cover at all the currency amount in circulation. In the late 60's, the American bank fears a gold rush leading to a crisis in the trust given into the trades. The FED (Federal reserve) copes with this situation by making deals with other Central banks. The banks agree on swaps of currency at a rate determined in advance. This is a first step in avoiding to golden standard ("How a 1944 Agreement Created a New World Order", n.d.).

The US got stuck in a mix of inflation and recession (called stagflation¹) in 1971 which resulted partly of the dollar being the global currency. Seeing the gold gaining more value and the devaluation of the dollar, a small gold rush occurred putting the Federal reserve in a tricky situation. In 1971, seeing the situation, Nixon stopped the value of gold and dollars going by pair by banishing the convertibility of the dollar in gold (Les Echos, 2011).

This ended the Bretton wood system, the precious metal is for now on just a precious metal ("How a 1944 Agreement Created a New World Order", n.d.).

¹ Stagflation means a simultaneous increase in prices and stagnation of economic growth. Retrieved from: <https://www.investopedia.com/terms/s/stagflation.asp>

5.5. The IMF and the World Bank

The international monetary fund had a crucial role in the Bretton wood agreement and still is a major player today. Indeed, for the countries to be able to keep their exchange rate still with the dollar, they needed a superior bank to borrow from to regulate the price of their national currency in the case of the states being short on their own funds. If this institution (the IMF) did not exist the countries would have to modulate their trade barriers or increase their interest rates ("How a 1944 Agreement Created a New World Order", n.d.).

The IMF was not given all the powers of a central bank by the countries. For instance, the IMF did not act as a global central bank that held a fixed pool of gold and national currencies for each country. The IMF worked as followed: every country gave a contribution to the IMF. Later on, depending on the limit of its contribution, each nation was allowed to borrow back from the IMF when needed. Of course, the IMF was enforcing the Bretton Woods agreement ("How a 1944 Agreement Created a New World Order", n.d.).

The world Bank was not acting as a bank as misleading as it is but as a help (through loans) for the rebuilding European continent after the war. Nowadays, the World Bank help in the economic development of developing nations ("How a 1944 Agreement Created a New World Order", n.d.).

5.6. IMF's Report concerning the Chicago Plan

In 2012, the IMF has published a report where they analyzed the vision of I. Fisher concerning the Chicago Plan. The results showed that they approve Fisher's claims. They agree that a system where the government issues the money, making the main asset in liquidity of the economy equity rather than debt, would allow the banks to focus on their domain expertise (invest in projects with a high expertise in risk management) (International Monetary Fund, Benes & Kumhof, 2012).

The IMF adds that the Chicago Plan would cope with the volatility in the business cycles (due to the fast-changing attitude of the banks concerning credit risk). Moreover, it would have as a consequence to diminish debt in the private and public world, and therefore limit bank problems (International Monetary Fund, Benes & Kumhof, 2012).

The IMF finds even more advantages than I. Fisher as according to them the inflation would be under control (kept still). This is an important finding as many detractors of the governments issued money state that it would lead to a crazy rate of inflation. The IMF found nothing supporting such a high inflation theory (International Monetary Fund, Benes & Kumhof, 2012).

5.7. Conclusion

We have studied how through history, some countries tried to find ways to facilitate currency exchanges. A common type of currency was first established by Napoleon. The same principle was used in the Latin union. Unfortunately, because of the bimetallic characteristic of the union and by the Thomas Gresham law, the system did not hold. Countries then looked for a new system the gold standard system being regulated by David Hume mechanism (price-specie-flow mechanism). But for it to work the countries had to not print more money than the gold that they had in the safe. With the wars, the printing of currencies got out of control and the gold standard disappeared at the favor of the gold exchange standard (thanks to the Bretton woods agreement). The USA were trusted to guarantee the value of the gold, but America needed more money and started to print in excess compared to the gold. In 1971, President Nixon decided to separate the dollars from the gold.

From then on, we enter into the fiduciary system meaning that there is no gold behind the currencies. Moreover, the currencies don't have any intrinsic value but simply represent a value.

6. The Fiduciary System

In this part, we will review on how the main actual European monetary union came to life (the *eurozone*). We will also study the actual money creation process. Finally, we will see that as the financial institutions are all connected, when a crisis occurs all the world is impacted.

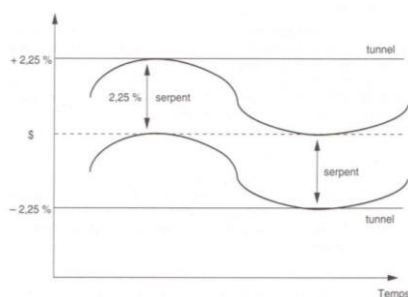
6.1. The Path to Euro

6.1.1 European Currency Snake

After president Nixon's decision to stop the convertibility of the dollars for gold, the members of the European Economic Community (EEC) decided to take actions through the Treaty of Basel. The EEC was created in 1957 through the treaty of Rome (following the goals of the European Community of coal and steel). The countries that are part of the Community were France, Italy, Belgium, Netherlands, Luxembourg, Federal Republic of Germany and later on Ireland, Denmark and Great Britain joined ("CEE", n.d.). The community will hold until 1993 where the treaty of Maastricht gave the basis of the future European Union (Investopedia, 2018). Another aim of this economic collaboration on the European level was to avoid new wars and conflicts (CVCE (Université du Luxembourg), n.d.).

Under the impulse of the French president Pompidou, the six initial members decided to set the European snake policy. This policy was in place from 1972 to 1978 and limited the fluctuations in exchange rates between European currencies. The bilateral fluctuations between the European currencies had to be kept between $[-2.25; +2.25]$. This bilateral snake had to stay in a controlled fluctuation with the dollar, this fluctuation was $[-2.25; +2.25]$ as well. The bilateral fluctuation inside the EEC represented the snake going into a tunnel, being the fluctuation with the dollar (CVCE (Université du Luxembourg), n.d.)

Figure 27: The European Currency Snake ("*L'intégration monétaire et financière européenne*", n.d., slide 3)



Having the different currencies getting closer on their exchange rate was part of the Werner report. This latter was a reflexion about the economic and monetary union led by Pierre Werner, the chief of the Luxembourg government at the time. The committee was called the committee Werner by simplification. The goal on the long term of the European currency snake was to eliminate all margins of currencies fluctuations inside the EEC. This goal will be reached with the introduction of the Euro thirty years later (CVCE (Université du Luxembourg), n.d.).

The European currency snake is fragile. Indeed, each central bank has to keep its currency inside the tunnel by making interventions with currencies from the community or with dollars. The central banks also have to support the dollar as otherwise the European currencies might appreciate and lose in competitiveness. Difficulties occur as soon as 1972, as the stock market is in doubt concerning the new regime instituted by Nixon. Indeed, there is no certainty that the currencies will align. Moreover, in the seventies Great Britain had poor social and economic performance and in June the country decides to let its currency free float. The Irish currency leaves the Snake and the Tunnel as well not long after that. The Danish couronnes leaves the snake but stay in the tunnel (CVCE (Université du Luxembourg), n.d.).

The system had a tough time with the first oil crisis in 1973 and the various policies put into place by the member states made it difficult to keep the fluctuations on hold. Moreover, the lack of European coordination led to abandon the European Snake currency in favor of a new system: the European Monetary System (Finance de Marché, n.d.).

The snake will not be able to hold for exceptionally long. In 1973, speculative attacks against the dollar forces the European authorities to intervene on the financial market. The decision was made to buy dollar which led to a domestic inflation. Italy has to cope with a bad economic conjuncture and stops its interventions on the international markets. Overall the speculation goes on the currency market. The snake has tied the European currencies and the dollar together forcing the Central Banks to act massively on the currency market. On March first, the Bundesbank, the central bank of the federal republic of Germany bought 3,7 billion dollars (unreached level to this day) and Bank of France bought 580 million of dollars in less than two hours. Not long after that several countries let their currencies float jointly with the dollar, the tunnel is no longer respected. Great-Britain, Ireland and Italy let their currency float autonomously, those currencies will never return to the snake. As the snake system was failing

the need to stop it and find a new system. This led to discussion during the Jamaica agreement (CVCE (Université du Luxembourg), n.d.).

6.1.2. 1976 : Jamaican Agreement

The official death of the Snake System was made official in 1976 by the Jamaica conference. The European leaders look for a new approach to ensure the stability of their currencies. Meanwhile, the finance ministers (gathered in a committee part of the IMF) decided to adopt a reform for the International Monetary System (CVCE (Université du Luxembourg), n.d.).

The Jamaican agreements legalize the exchange rate policy and end the system of fixed exchange parity (L'or et l'Argent, 2009).

6.1.3. The European Propositions for Monetary Stabilization

The end of the snake monetary system and this free-floating situation starting obviously threatens the good functioning of the common market and European integration. Decisions will be taken to ensure the continuity of European integration (CVCE (Université du Luxembourg), n.d.). Indeed, in his report the Belgian prime minister Léo Tindemans (1976, p.11) stated: *"An unfinished building cannot defy time: it must be completed, otherwise it collapses"*.

To fulfill this wish and need for a new system, the European Monetary System was put into place in 1979. This system aimed to link several European Currencies in order to maintain their exchange rate as stable as possible (Investopedia, 2019).

The system globally worked as the spread in exchange rates between European currencies are smaller than the exchange rates between European currencies and other bigger currencies (such as the dollars and the Yen) (CVCE (Université du Luxembourg), n.d.).

In general, the EMS promotes macroeconomic surveillance and discipline. Compared to the European snake, the devaluation is not seen like a national matter but a global decision (involving many countries) (CVCE (Université du Luxembourg), n.d.).

The European Monetary System was based on a common monetary unit called the European Currency Unit (introduced in 1979). This unit is an artificial currency balanced according to the output of each of the twelve countries being part of it. The exchange rates were determined using this European Currency Unit (Investopedia, 2019).

This system will know several crises (permanent withdrawal of Britain, for instance) that will push some countries to exit the system. It will lead eventually at the creation of Euro (Investopedia, 2018).

6.2. The Birth of Euro

The European union came into life after the signing to the Maastricht treaty in 1993. The European Central Bank was created in 1994 (under the name of European Monetary Institute). In 1999, the EU introduced the euro and the physical expression of this currency (notes and coins) came into life and was launched in the system in 1992 (Investopedia, 2018).

Euro is still the currency used in most countries of the European Union. But even though, it brings a lot of advantages, it also has its flaws.

A critic of Euro is that it is aligning itself with the strong economies (such as Germany) (Investopedia, 2019). And as all the countries have to align with one and only currency, unable to devalue or reevaluate their currency, the factor of production adapts to translate the differences between the Euro Zone countries. For instance, Southern countries to gain in competition has to lower drastically the wages and the price leading to a hard situation for the inhabitants. This global phenomenon tends to help the strong members of the union and to hurt the weak. A mistake that has been made in the conception of Euro is to have believed that it was possible to harmonize social/economic realities by the top (with the Euro) with no changes coming from the bottom. Such harmonization would take decades of course, in regards of this fact, Euro has been launched quite abruptly (Bruno Colmant, 2017).

6.3. The 2008 Crisis

One major event that happened in the last years and that highlighted the defaults of a common financial system on the world level is the subprime 2008 crisis.

This crisis originally started in the US. In 2001, the Federal Reserve in order to fight the recession, lowers its interest rates from 6,5 % in 2001 to 1,75% in December 2001. Because of this decision, many investors were able to take loans at a particularly good rate. Unfortunately, some of those investors had no assets and no income to guarantee such loans. Many of those unsafe investors had as a dream to invest and buy their own home. The banks were willing to

help them to achieve their “dream”. The federal bank decreased to interest down to 1% in 2003. At the same time the price of the houses kept increasing (Investopedia, 2019).

The bankers took those loans and transformed them into collateralized debt obligations that were passed along to investors. This phenomenon soon gave birth to a huge subprime secondary market. Unfortunately, even though the interest rates went down they eventually also went up. This is the point where issues started as the unsafe investors were not able to pay back their loan plus the interests. The banks that made those loans started to go bankrupt in 2007. Financial firms and Hedge Funds owed more than a trillion dollars base on those subprime. This led to a financial tsunami that went worldwide. The central banks outside the US, seeing that the financial market was not able to cope with the issue, started to gather in order to try to prevent the crisis to spread further. The US federal bank decided with the national economic stabilization act of 2008 to issue 700 billion dollars to buy back the securities and mortgage linked to the subprime (Investopedia, 2019).

It is possible to make a parallel between the subprime crisis and the assignats crisis (developed earlier in this thesis). Indeed, France needed finances and therefore allowed people to buy clerical properties through the assignats. The assignats had to be destroyed once that they were used but France needed increased finance. The country lowered the standards to allow more issuance which led to a hyperinflation crisis. Eventually, the Director cancelled the assignats. This way of doing things is remarkably similar to the subprime as a loose regulation leads to catastrophes where many people lose all their belongings (Bruno Colmant, 2018).

6.4. Money Creation in 2019

The architecture of the bank system today has three layers. First, on top of the pyramid are the central banks. Those central banks have 3 main roles: monopoly on the impression of bank notes, monetary policy (through the interest rates) and lender to commercial banks in last resort. Secondly, below the central banks stand the commercial banks (such as BNP Paribas Fortis). Finally, under these two types of banks stand the clients (enterprises and individuals). Those clients have bank accounts in the commercial banks and the commercial banks have bank accounts in the central banks (Souchon, 2018).

As strange as it sounds, money is not created by the central bank but by the commercial banks. The commercial banks create more money than what they actually have in the safe in order to give loans to clients (Souchon, 2018). This is what is called the “loans make deposits”. Concretely, when a deposit is made by a first economic agent in a commercial bank it can be used (except for some restrictions) by the commercial bank as a loan for second economic agent. This second economic agent will use this money and will eventually become a deposit itself. This phenomenon is called the bank multiplier. Those commercial banks nationalized or not represents the wall between money and the governments guaranteeing this currency (Bruno Colmant, 2017).

This credit multiplier system has an impact on the level of prices (by the I. Fisher quantity theory). When the economy is booming and that many people are asking for a credit to the bank, the commercial banks create those credits by a simple line in an accounting book. When many of those credits are issued, people spend more because they have money, thus the general level of price increases. This is the inflation, that can cause issues if the wages do not increase as fast as the price. If the opposite phenomenon happens, we will be in deflation which is also dangerous as the economic activity will slow down. It is therefore important to keep control on the inflation/deflation. To do so, Central Banks adapt their directional interest level. This interest level has a direct impact on the credits given by the commercial bank to the individuals. The smaller the interest rates, the higher the demand for credits (it will be cheaper to borrow) and the higher is the prices. The higher the interest rate, the fewer the demand for credits (it will be more interesting to spare money) and the lower is the level of price. Every month, the central bank sets a new interest rate in order to control the inflation of our economy. Many economists agree to say that an inflation between 2 and 4 % is great for the health of the economy (Dessine-moi l'éco, 2012).

6.5. Legal Tender

Along history as soon as the objects became institutionalized, the legal tender appeared (for instance the salt was a mean to pay wages and to gather the taxes during Antiquity).

Legal tender is an expression that applies to the currency in circulation in a country. It means that this currency cannot be refused in settlement of a public or private debt. Paper money (banknotes) and metallic money (coins) are legal tender. Of course, currencies that are widely

accepted such as US dollar or euro are accepted as legal tender in many nations, especially with weak currencies (Investopedia, 2018).

As soon as the eurozone was created in 2002, national currencies became obsolete and the euro became the only legal tender throughout the area (Barber & Wassener, 2002). Failure to comply with legal tender requirements, i.e. to refuse coins or banknotes which are legal tender for their nominal value, is punishable.

Today, all complementary currencies and cryptocurrencies, presented in the next section, are considered as alternative currencies, as they are not legal tender in any country (i.e. state-backed).

6.6. Conclusion

The credibility of any currency also comes with the capacity of the public institution to guarantee the quantity of the currency as well as its quality. Back in the days, when currencies were a merchandise in itself as the metal had to be extracted from the mines, the power of extraction maintained this credibility. Nowadays, national currencies are scriptural, and their value is guaranteed by a trustworthy institution (Bruno Colmant, 2017).

7. Complementary Currencies

In the wake of the financial crisis that shook the planet in 2008, interest in various monetary systems has gradually increased. This is how many societies have expressed interests in the creation of a local currency, also called complementary currency. Such developments indicate a rising awareness of the economic, social and environmental benefits of the Community currencies. Partly funded by the EU, the Complementary currencies in Action (CCIA) project has recently published a series of legal and compliance guides covering the relevant legislation in Germany, Belgium, France, the Netherlands and the UK (Le projet européen CCIA, 2015).

The Economist Richard Douthwaite defines three sorts of money. First of all there is the **bank money** which is created by private banks when they offer loans. Then, there is the **government money** which consist in the notes and coins created by governments. Finally, there is the **people money**, also called complementary currency (Kennedy, M., Lietaer, B., & Rogers, J., 2012). These complementary currencies are created by private citizens or groups to create markets for precise goods and services often within a geographic region to regulate the economy or accomplish a purpose, whether in the economic, environmental or political field (Investopedia, 2019).

Complementary currencies do not replace the national currencies, they act in parallel with it. The national currencies support industrial growth, international trade between markets and wealth creation. They are driven by interest rate, and mostly hierarchical and monopolized organizational structures. However, a complementary currency is not legal tender and cannot be speculated. It cannot be used to pay debts or national debts neither. Some of them may lose their value over time. However, if they are well designed, complementary currencies can stabilize the whole economic system because they will accelerate trade at the local level to benefit the real economy (support for employment, brake relocation) (Kennedy, M., Lietaer, B., & Rogers, J., 2012).

7.1. Types of Complementary Currencies

There are two types of complementary currencies: commercial or community oriented (Kennedy, M., Lietaer, B., & Rogers, J., 2012).

7.1.1. Commercial Oriented

These types of complementary currencies with a commercial purpose are already well-known by the population. For example, airline miles, also known as flyer miles or travel points are a loyalty program offered by airlines. Mostly, the customer accumulates several miles based on the characteristics of the travel and can then use it to buy tickets (Kennedy, M., Lietaer, B., & Rogers, J., 2012).

Another example is the business-to-business exchange like the RES in Belgium, which will be discussed further on in this part (Kennedy, M., Lietaer, B., & Rogers, J., 2012).

7.1.2. Community Oriented

Also called community or local currencies, the goal of community-oriented currencies is to develop community networks and support social and ecological goals. They are used by people with a common connection, like members of an association. It can be geography-based, in this case we talk about a local currency (Kennedy, M., Lietaer, B., & Rogers, J., 2012).

7.2. Regional Currencies

“A regional currency is a particular form of complementary currency: it is an agreement within the community of a region to accept something other than legal tender as a means of payment. It connects unused resources with unmet needs at the regional level.” (Kennedy, M., Lietaer, B., & Rogers, J., 2012, p.19)

The money, as we know it, has three functions: exchange medium, unit of calculation and storage medium. The saving aspect nonetheless goes against the exchange aspect of the money and therefore does not get involved in the job creation phenomenon. The regional currency exactly intervenes in the boosting of exchange medium and reducing the storage medium. As the regional currency does not have any interest rate, it does not make sense to store it. Accordingly, its purpose is to create local jobs and improve the purchasing power in the region by boosting the economic growth. When people are losing their jobs and money become rare, regional currencies step in (Kennedy, M., Lietaer, B., & Rogers, J., 2012).

Certainly, regional currencies also have their advantages. First of all, they cannot be used as legal tender, to pay back national debts or taxes for example. Then, not only governments but also businesses are not obliged to accept them. They are not internationally recognized so their use out of the region is limited. It cannot be capitalizing to earn interests as the banks do not recognize them neither. Overall, they have a different use than the national money. As aforementioned, it is not anti-national money. It has a different role, it fills local gaps.

Although it is possible to quickly destroy the regional currencies by imposing a national currency, our current politicians support increasingly regional autonomy. Yet, this is paradoxical with the monetary globalization intentions. In the 19th Century, when the Britain colonized Africa, this latter was using many regional currencies according to its traditions. Britain, however, had to find a way to create a demand for its exported goods. They produced the solution of introducing a new national currency and instituted a small tax only payable with it. People needed to find a way to obtain this currency and this was enough to disrupt the already-in-place regional standards (Kennedy, M., Lietaer, B., & Rogers, J., 2012).

7.3. Examples

7.2.1. Banco Palmas, Brazil

Banco Palmas is a solidarity microfinance institution, created in 1998 by residents of the Conjunto Palmeiras district, twenty kilometers from Fortaleza in northern Brazil. It combines different financial services, including microcredit, with a local circulating social currency, the "Palmas". Banque Palmas provides microloans for production and consumption (Diniz, E. H., Cernev, A. K., & Nascimento, E., 2016).

Production loans are issued in Brazilian Real, the national currency. They are used to create an activity or to support it. The bank favors support for projects that respond to demand in the neighborhood through regular mapping of consumption and local production that identifies needs and opportunities (Diniz, Cernev, & Nascimento, 2016).

Consumer loans are issued in "Palmas", the local currency issued and managed by the community bank (a palmas = a real). They are exchangeable in real by the producers to provide raw materials outside the district, but not by the consumers who, when they consume, in Palmas, in the shops of the district, receive a count of 2 to 15% on the "normal" price of the

product purchased. Thanks to the social currency, there is a relocalization of the local economy and a dynamization of the territory at the service of the community (Kennedy, M., Lietaer, B., & Rogers, J., 2012).

Banque Palmas is not just a financial institution. It is at the heart of the life of Conjunto Palmeiras, and a network of local solidarity economy. At the headquarters of Banque Palmas, residents queued every day to ask for a credit, collect their pension, pay their water or electricity bills, or open an account. The premises of the community bank also host several solidarity economy enterprises. The bank is also supporting young people and women in the neighborhood at social risk to find a job (Kennedy, M., Lietaer, B., & Rogers, J., 2012).

As a result, the currency has created jobs for hundreds of people, used exclusively by many people and imitated around the world greatest countries. Even the president of the Central Bank presented its excuses for its early unfavorable treatment for Banco Palmas. Banco Palmas is thus a good community currency success story (Kennedy, Lietaer, & Rogers, J., 2012).

7.2.2. WIR Bank, Switzerland

WIR Bank is a Swiss banking institution that issues its own currency to facilitate economic exchanges between its members. It is headquartered in Basel. WIR is the abbreviation for the German word Wirtschaft, which means "economy", WIR also means "we" in German (Kennedy, Lietaer, Rogers, 2012).

The film "Tomorrow" also spotlights this remarkable Swiss initiative that is more sectoral than local, which has specialized in financing small businesses since the 1930s. It is a cooperative that lends its members a complementary currency (secured on the Swiss franc) at low interest rates (below market rates), in which they can carry out their mutual exchanges. The WIR Bank has 62,000 members who exchange more than 1.6 billion WIR francs per year, 1 WIR franc equals to 1 Swiss franc. In 2010, one in five Swiss SMEs used the WIR franc. It corresponded to 60,000 businesses, around 16% of all Swiss enterprises uses WIR francs diverse ways for businesses; to buy goods (including property), to pay business expenses, to pay capital and private expenditure and last but not least, to pay employees. It is already a broad use of the currency which leads us to think that the role that such a financial institution plays in the prosperity of the Swiss economy. The film also offers a view on the WIR Bank that indicates the usefulness that such a system could have for a country like Greece. While its links with the

euro condemn its entire economy to austerity in order to repay its debts, the introduction of an independent currency for the benefit of a large network of SMEs, used only in the country and by these companies to settle their reciprocal trade, would allow the restart of certain sectors of the economy and job creation (Dion, C., Laurent, M. and Levy, B., 2015).

Given the circumstances, although in 2010 the WIR's turnover represents 0.32% of the Swiss GDP, it is proven to be stabilizing the economy of the country, especially during recession times. The WIR is a good example of a successful regional currency. It is a very stable system, not prone to failure, or systemic crisis. It remains fully operational even in times of widespread economic crisis (Dion, C., Laurent, M. and Levy, B., 2015).

7.2.3. Euskos

The eusko, created on the 31st of January 2013, is a complementary currency issued by the non-profit association Euskal moneta. It is used in the French Basque Country by companies, businesses and associations. The purpose is to boost the local economy and promote short circuits. This local currency also aims to promote an "ecological and solidarity-based society". It is one of the most important currency in Europe by its network and the money supply in circulation (Etchekeleku, 2017).

Four years after the tickets were issued in the Basque Country, the currency took the digital turn, consumers are able to make transfers online and be equipped with payment cards for transactions in eusko (Etchekeleku, 2017).

1 eusko equals to 1 euro and the currency is circulating in the form of secure notes of 1, 2, 5, 10 and 20 eusko. Anyone can go to an exchange office and join the network in a few minutes, then make their first exchange of euros in eusko, by giving either a check or cash. This can also be done online (Etchekeleku, 2017).

With more than one million eusko in circulation at the beginning of 2019, more than 3200 individual members, a network of 820 professionals, 17 member municipalities and the Basque Country Urban Community, Eusko is one of the most important complementary currency in Europe. As at 31 December 2018, there were 1,097,280 eusko in circulation (+46% compared to 2017): 412,000 in banknotes, and 685,000 in digital eusko accounts. Thanks to the 3% Eusko

system, 18,890 eusko were distributed to 46 associations in 2018, for the period from 1 July 2017 to 30 June 2018 ((Etchekeleku, 2017).

Today, 50% of management costs are covered by members' contributions, but the other half is financed by public subsidies and wage subsidies. Although eusko has a very extensive network in France, it has to face financial autonomy. The eusko still has a lot of room for improvement especially when it comes to those who change their minds and wish to change their eusko back into euros, they should expect a penalty: at the time of conversion, they will be charged a 5% commission ((Etchekeleku, 2017).

7.2.4. RES, Belgium

Founded in Leuven in 1996, RES is a new currency that aims to stimulate the local economy. It has the same value as the euro but is accepted exclusively in the circuit of merchants affiliated to the RES system. Today, hundreds of businesses, shops and restaurants accept RES as a means of payment, but large international chains are excluded. Some merchants accept the total purchase amount in RES (100%), and others limit it to 50% or 75% RES. In 2018, 1,486 merchants opened a free RES account for an accumulated total of 6,323. 56,947,706 purchases were done in RES with 411,519 transactions and 19,919 consumers already used the RES PREPAID card (RES, n.d.).

Walther Smets started this RES business. He was a local businessman living in Leuven, owned several restaurants and sold all of them to launch a furniture business. It did not go well until another businessman offered him media space in exchange for furniture. At that moment, Smets realized there was a potential market for a local currency, used to protect small businesses and most importantly, to avoid the banks. At first the businesses were not persuaded about the idea but thanks to Walther Smets's conviction, increased businesses joined the network. The creator took the time to analyze other complementary currencies such as WIR and adjusted his system to the rules that had worked elsewhere (Kennedy, Lietaer, & Rogers, 2012).

The name comes from the Latin *res* meaning 'business' or 'interest'. Members of the co-operative are divided between A, B and C shareholders. As mentioned earlier, 1 RES equals to 1 euro. Thus, the RES ties to national inflation but it is not a preoccupation for the creator as he knows he can always float free from the euro if it is necessary (Kennedy, Lietaer, & Rogers, 2012).

Although it sounds like a good example of a complementary currency in Belgium, some people complain that the RES is not helping the ordinary people but only the already-in-place and productive businesses. Plus, the government is not recognizing this currency, which is a concern for its creator. Furthermore, on the 18th of April 2019, the National Bank of Belgium informs the public that RES Prepaid BVBA was declared bankrupt on 18 April 2019 by the Leuven Insolvency Court. The RES website also published the news regarding the bankruptcy of the RES prepaid cards for individuals. They informed the public that they are trying to find a solution to that problem but in the meantime, the other companies of the RES group have not been declared bankrupt (Banque Nationale de Belgique, 2019).

7.4. Conclusion

We learnt that complementary currencies have significant role in the economy but are not sufficient for sustainable regional development. At times, they are based on the old exchange models and some of them are a good success story while some of them are not. They are not necessarily recognized by the governments, for example the RES, but are for sure helping the local economy to survive. We think that a balanced dual currency (a national and a complementary) would ideally be more efficient for a country. This does not seem to be the perfect solution to all the problems, but these lessons could be useful for the future of our increasingly global world, especially if we look at the example of Banco Palmas, which has succeeded in strengthening its local culture.

8. Cryptocurrencies

“A crypto currency is a digital or virtual currency that uses cryptography for security. A cryptocurrency is difficult to counterfeit because of this security feature. Many cryptocurrencies are decentralized systems based on blockchain technology, a distributed ledger enforced by a disparate network of computers. A defining feature of a cryptocurrency, and arguably its biggest allure, is its organic nature; it is not issued by any central authority, rendering it theoretically immune to government interference or manipulation.” (Investopedia, 2019, para 1).

Cryptocurrencies are digital means of exchange created and used by private individuals or groups. Therefore, their demand and supply are controlled by the activities of users and not the intentional decisions of central banks or states. Cryptocurrencies use cryptographic protocols, or extremely complex code systems that encrypt sensitive data transfers, to secure their units of exchange. These protocols are built based on advanced mathematics and computer engineering principles that make them virtually impossible to break, and therefore to duplicate or to fake these cryptocurrencies (Swammy, Thompson & Loh, 2018).

Except few exceptions, most cryptocurrencies are designed so that the creation of new money units is gradual, while placing, for most of them, a ceiling (a maximum amount) on the money supply that will ultimately be in circulation. This is done in order to avoid hyperinflation (Swammy, Thompson & Loh, 2018).

On the opposite to ordinary currencies held by financial institutions, cryptocurrencies are managed by a large account book open and viewable by all (the blockchain) which lists all transactions since the origin (Swammy, Thompson & Loh, 2018).

A cryptocurrency is therefore not occult to the extent that any transaction is available on the Internet with reference to the e-mail address of the issuer and receiver accounts and the amount of the transaction. However, these transactions are in principle unfalsifiable and inviolable, thanks to intensive use of cryptography. But there are exceptions to the rule of anonymity, such as Darkcoin, Zerocoin, Bytecoin and the Black Coin.

8.1. Blockchain Technology

“The underlying technology for digital currencies is blockchain which is an electronic distributed ledger technology (DLT) that forms the basis of Bitcoin and which now serves as the foundation for other cryptocurrencies.” (Girasa, 2018, p.29)

The history of blockchain is ambiguous with different claimants to aspects of its technology. Although today its use is mainly known through the Bitcoin, it seems that it was earlier used in 1991 by an article in Wikipedia. The authors, Stuart Haber and W. Scott Stornetta were aiming to secure digital documents and therefore proposed a cryptographically verifiable label for any bitstring (Girasa, 2018).

Basically, a blockchain is a new method of record keeping. Instead of doing it in a centralized method with one entity having all the information, it is a decentralized method with many computers working together to distribute a distributed shared ledger, simultaneously and through a common consensus. So rather than having to rely one entity and the risks associated to it including fraud, corruption, hacking, break-downs, there are multiples versions of it being jointly produced. This allows the peer-to-peer exchange, excluding the intermediary (Investopedia, 2019).

Blockchain is a chain of blocks containing (monetary) digital information (the “block”) which is stocked in a public place (the “chain”). There are three parts in the blocks :

- Information about transactions: date, time, amount of most recent purchase
- Information about the participants in transactions
- Unique codes called “hash” to distinguish every block

A block can house thousands of transactions (Investopedia, 2019).

For the blockchain to work, four things must happen; the transaction happens, the transaction is verified, the transaction is stored in a block and finally the block is given a hash. *“Hash codes are created by a math function that turns digital information into a string of numbers and letters”* (Investopedia, 2019, para 19). Once the block is hashed, it can be added to the blockchain. Every new block added to the blockchain becomes available to the public and everyone is able to see it, even the persons that are not involved in the transaction or the blockchain (Girasa (2018).

As the blockchain is not private, every computer in the blockchain network have copies of blockchain. In the case of Bitcoin, millions of copies of the same blockchain are created. This means that information cannot be manipulated. If a hacker wants to manipulate it, he needs to do it for every copy of the blockchain on the network because every hash contains the hash of the block before it. For example, if a hacker wants to change the settings used for a block, he will need to do the same manipulations for the blocks before, in order to cover its track (Girasa, 2018).

Personal information is available on the blockchain; but only the signature and username can be viewed (Girasa, 2018). It is therefore considered to be not completely public, which raises a question that will be discussed further: how can we trust the blockchain system if we do not know who is behind the blocks?

In order to add blocks, which is called “mining”, computers should pass some tests to prove themselves. One of the main examples is the **proof of work** which rewards the first person “to solve the problem”. In fact, the computer has to solve overly complex problems (hash) for every transaction and therefore to prove that they did “work”. It is understood that to solve these complex problems, computers must be highly equipped, and this can be very costly, but they get a reward in exchange. Proof of work somehow prevents hacking attacks by making them exceedingly difficult. If a hacker wants to hack the blockchain, he needs to solve these complex problems as well (Investopedia, 2019).

The **proof at stake** rewards the person which is “already in the problem”, depending on how many coins he/she holds. It means that the more a person has holds coins, the more he has the power to validate new blocks and therefore get rewarded for it. This is an alternative to proof of work. Indeed, in the proof of work system, the person who solves the problem sells its awarded cryptocurrencies for fiat money. And as from the most classical demand and offer theory, this leads to a decrease in the price of the cryptocurrency. Proof of stake is exactly created to encounter this problem by attributing mining power to the proportion of cryptocurrencies held by a miner (Stealth’s blockchain, 2019).

In today’s world, blockchain has many uses. Not only it is used in cryptocurrencies, but it can also be used by banks, healthcare system, property records, smart contracts, supply chain, voting system, ... (Investopedia, 2019).

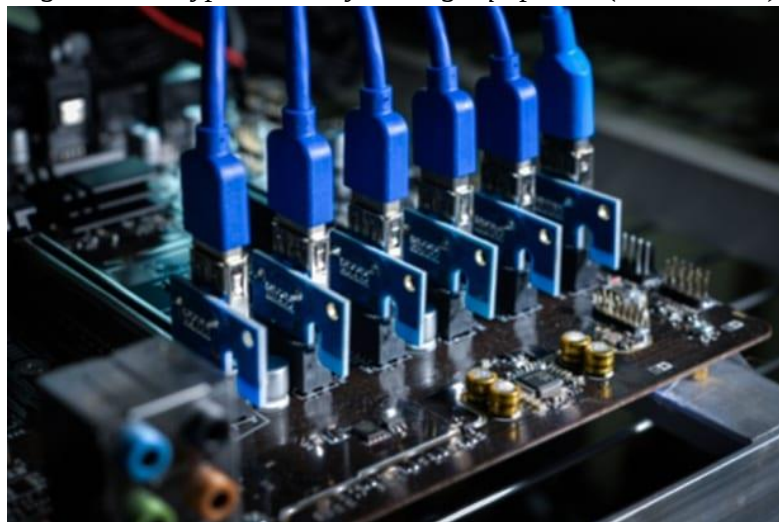
8.2. Mining Process

As said above, there is no bank to produce new copies of cryptocurrencies, the activity of mining ensures the production of new units. Cryptocurrency mining is a process in which transactions for several types of cryptocurrency are checked and added to the *blockchain digital ledger*. Every time a cryptocurrency transaction is made, a cryptocurrency miner takes responsibility for ensuring the correctness of information and bringing up-to-date the blockchain with the transaction. Therefore, there is no trust problem between participants (Stroud, n.d.).

Cryptocurrencies are created according to a protocol that remunerates agents who have processed transactions. Thus, the mining process itself involves a competition between each cryptocurrency miners to solve complex mathematical problems, as the first one to crack it is rewarded by controlling the transaction (Stroud, n.d.).

Minors can be individuals or companies that connect one or several equipped machines on the cryptocurrency network. These agents use their computing power to verify, secure and register transactions in a virtual registry, called the blockchain, a name that comes from the fact that the base entity of cryptocurrency is called a block, and that the blocks are then connected in a chain, the chain of blocks. The equipment consists essentially of a graphics card or specialized circuits (ASIC) associated with a mining software. The miner with the most dedicated equipment has competitive advantage above others (Noizat, 2013).

Figure 28: Cryptocurrency mining equipment (Mason, n.d.)



The mechanism itself is secured by a well-known cryptographic process called “proof of calculation”. It is a form of cloud computing that ensures the security of the cryptocurrency network (Noizat, 2013).

The main difficulty of mining is to solve a proof calculation to write new transactions in the bitcoin database (public and shared by all network participants). Each new proof of calculation gives rise to a new block of transactions in the cryptocurrency blockchain. The level of the proof of calculation is adjusted every week or two weeks depending on the cryptocurrency.

8.3. History of Cryptocurrency

It is important to highlight that Bitcoin is not the first cryptocurrency, but the first one who has gained success. Before the most-known bitcoin, many cryptocurrencies have been developed until the first full implementation of bitcoin in 2009 (Swammy, Thompson, & Loh, 2018).

In 1993, the first electronic cash system called “eCash”, was created by David Chaum. The principle was to exchange anonymous electronic money by storing it in a digital format signed by a bank. This was then transformed to “Digicash” in 1995 and required user software to withdraw notes from a bank or encrypted keys before sending the money. The privacy was established on a system of “Blind Signatures”. Thus the digital currency was untraceable by the issuing bank, the state or any third party. In the late 1990s, David Chaum disabled DigiCash because there were not enough merchants recognizing it (Swammy, Thompson, & Loh, 2018).

In 1998, Wei Dai published a description of “b-money”, an anonymous electronic cash system. Shortly after, Nick Szabo created the “Bit Gold” which required users to complete a proof of work function whose solutions were encrypted, put together and published (Swammy, Thompson, & Loh, 2018).

8.4. Bitcoin [BTC / XBT]

8.3.1. Launching

On the 3rd of January 2009, the first blockchain-based cryptocurrency called “Bitcoin” was launched by an anonymous programmer or group using the pseudonym of Satoshi Nakamoto. “Bitcoin” is the contraction of the words “bit”, which corresponds to a binary unit of measure and “coin”, money. Satoshi Nakamoto was bored of the classical payment methods, fed up with

the control and manipulation of the money by the central banks, completely under the control of the government. Thus, he produced a protocol that would not be bound by any institution or organization and could not be closed or forbidden in any way and named the protocol blockchain. This underlying technology of blockchain has permitted the growth of cryptocurrency. Today, bitcoins as well as other cryptocurrencies serve as tokens in blockchain systems (Halaburda & Sarvary, 2016).

Bitcoin is therefore a decentralized, immutable, private, and anonym payment technology without double spending. Users are exchanging private keys based on an encrypted address protected by public to keep personal holdings.

8.3.2. Means of Payment

The broad interest in the cryptocurrencies has made it considerably easier to buy and trade them. On the 29th of October 2013, the first automatic bitcoin exchange-distributor was put in use in Vancouver (Figure 29). There are two types of crypto ATM: the first one only allows to buy a cryptocurrency while the second one allows both to buy and sell cryptocurrency. Nowadays, ATMs also allow operations for Bitcoin for also other coins such as Ehter, Dash, Litecoin, Zcash, Monero, Dogecoin, ... People can either use their own created wallet address or leave the ATM generate one for them. In this case, a paper with a public and private code is printed ("Bitcoin ATM Map", n.d.).

The number of crypto ATMs keep on increasing, reaching 4721 in May 2019. Available in 77 countries, a majority of these ATMs are located in the United States. In Belgium, there are 12 machines ("Bitcoin ATM Map", n.d.). See Appendix 1 for ATM installations growth and Appendix 2 for ATM installations by country. We can notice that in Belgium, currently there are 12 ATM.

To buy bitcoins, there is general buying process mostly applicable to all ATMs. First of all, there is the verification step. Secondly, the address for deposit is enclosed. Then, the cash is inserted into the ATM and finally the operation is confirmed. Of course, this process may be more or less complicated and long, depending from machine to machine ("Bitcoin ATM Map", n.d.).

The general process to sell Bitcoin starts again with the verification step. Then, an ATM QR code is generated for depositing bitcoins. Bitcoins are sent to this wallet address and depending on the settings, either the cash is received immediately (for lesser amounts) either there is a confirmation waiting time ("Bitcoin ATM Map", n.d.). See in the Appendix 3 the number of bitcoin machines supporting buy and sell.

Figure 29: Bitcoin ATM (Steemitblog, 2017)



The first bitcoin shopping took place on the 22th of May 2010 with a purchase of pizza for 10,000 Bitcoin, equivalent to \$25) (Watson, 2018).

8.3.3. Exchange Rate

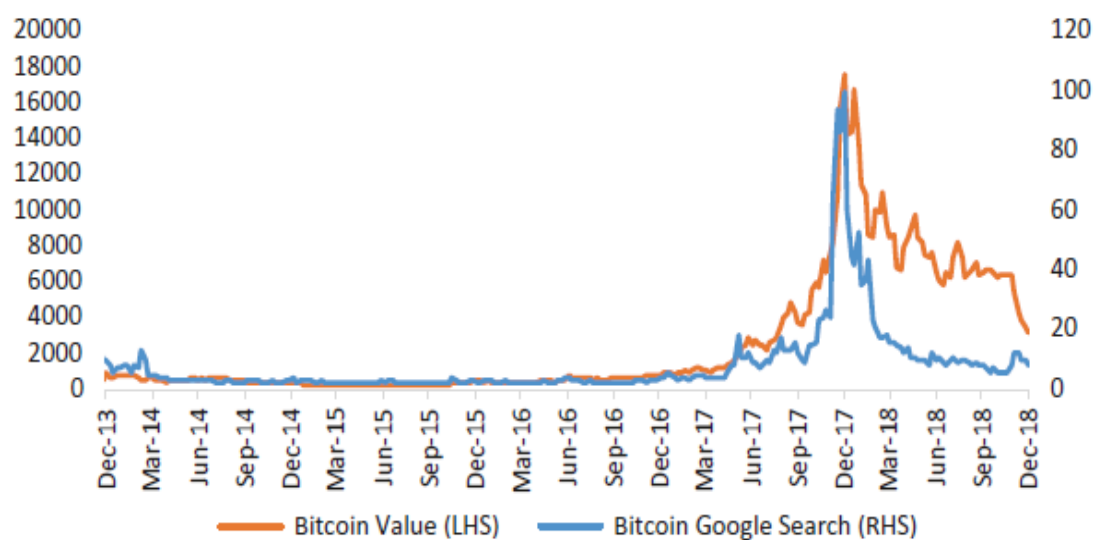
Bitcoin's unit of account is bitcoin. Its issue is limited to 21 million units, each divisible up to the eighth decimal place (Halaburda & Sarvary, 2016). The corresponding acronyms used by the exchange platforms are BTC and XBT. Among the unofficial symbols used, we can find ₿ and B.

It is possible to buy bitcoins online on specialized platforms. These platforms also make it possible to follow in real time the price evolution of bitcoin with respect to other currencies or cryptocurrencies.

The cryptocurrency exchange rate is set mainly on specialized marketplaces and fluctuates according to the law of supply and demand. As the cryptocurrency value expands, so the interest in them. The following chart (Figure 30) illustrates the google searches for the term

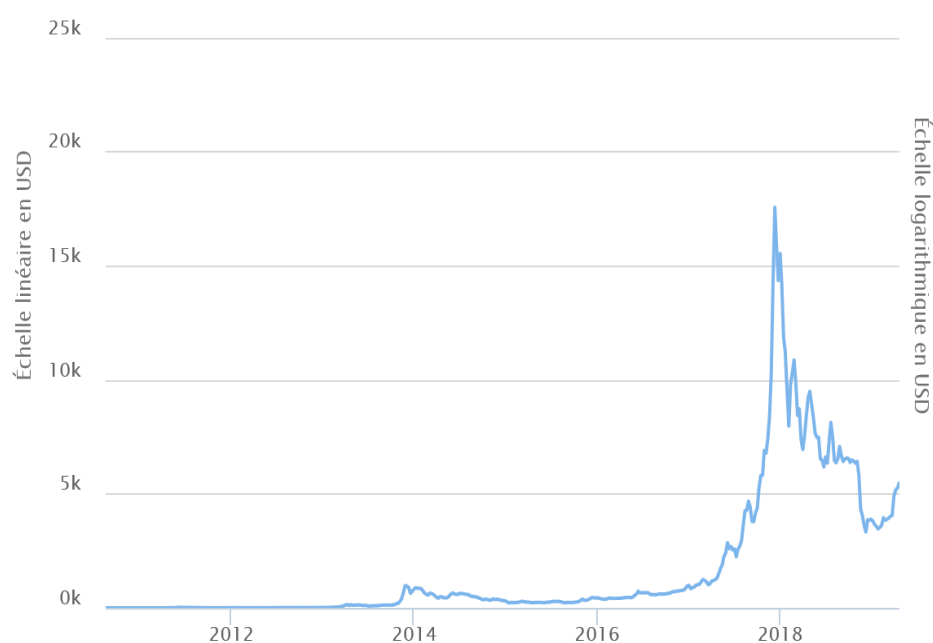
“Bitcoin” as well as the value of the Bitcoin itself. Hence, the value of the Bitcoin depends on its volatility (Halaburda & Sarvary, 2016).

Figure 30: Interest in Bitcoin tracks and value of Bitcoin (Swammy, Thompson, & Loh, 2018).



As from the chart (Figure 31), accessed on May 4, 2019, 01:30 PM, we can see that the value of Bitcoin has increased by 13x in 2017, with important difficulties from then, highlighting the speculative nature of it.

Figure 31 : Bitcoin price graph (Buy Bitcoin Worldwide, n.d.)



8.3.4. Bitcoin: Quasi-Money

Bitcoin is considered as a *quasi-money* ; although is not a complete money, it is a class of monetary assets that can be used to make transactions and hoarding (Colmant, 2019).

Today, governments and monetary authorities refute bitcoin, which impairs their ability to impose their sovereign right to mint money to raise taxes and secure their debt. The G20 considers that Bitcoin is a "crypto-active" that does not fulfill the role of a currency. The term "crypto-active" then refers to "virtual assets stored on an electronic medium allowing a community of users accepting them in payment to carry out transactions without having to resort to the legal tender".

8.4. Other Cryptocurrencies

Despite the success of Bitcoin that was traded 24 hours per day, 7 days per week, since 2010, other cryptocurrencies were developed as from 2014 and are competing with Bitcoin. In a decade, the number of cryptocurrencies increased from 1 to 1600 (Swammy, Thompson, & Loh, 2018).

A majority of the alternative cryptocurrencies were developed thanks to the **“initial coin offerings” (ICO)**. In fact, programmers can raise money by creating and selling their cryptocurrency using a framework like Bitcoin or Ethereum. Since 2013, ICOs have often been used to fund development of new cryptocurrencies. The pre-built icon can easily be sold and traded if there is a request for them on all password exchange exchanges. With the success of Ethereum, the ICO is increasingly being used to fund the development of a new crypto project, with the release of a token that is integrated into the project. The demand for ICOs is rising rapidly, since the amount of investment in ICOs in 2017 is seven times the total amount made until 2017 (Swammy, Thompson, & Loh, 2018).

Figure 32 displays a ranking of market capitalization of cryptocurrencies above at least 1\$ billion on May 4, 2019, 01:55 PM. We can quickly remark that bitcoin has the leading position, followed by Ethereum. For a better understanding, we will analyze these alternative cryptocurrencies and some others.

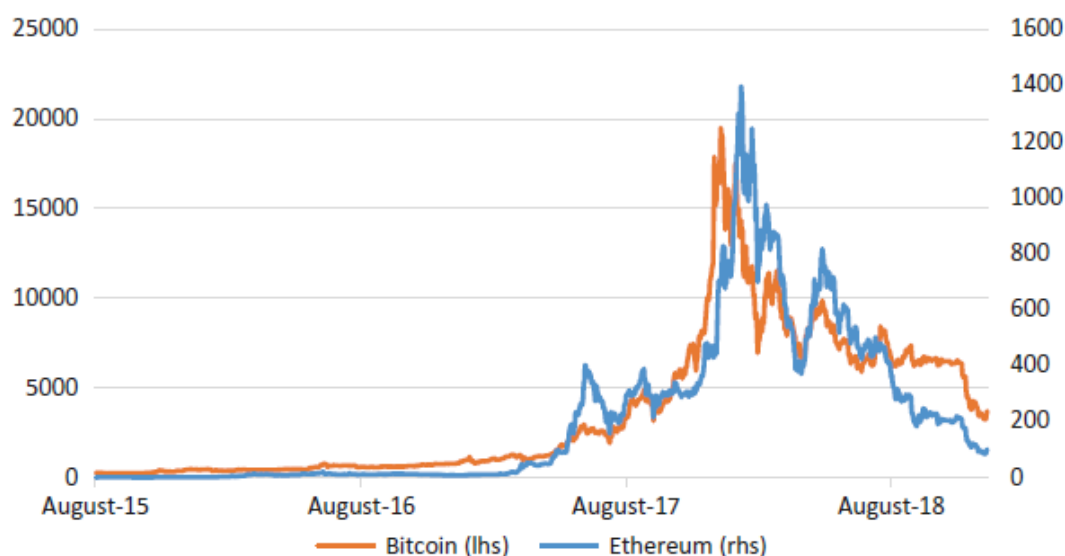
Figure 32: Cryptocurrencies comparison (CryptoCompare, 2019)

#	Coin	Price	Total Vol. 24H ⓘ	7d Chart (USD)	Chg. 24H
1	 Bitcoin BTC	\$ 5,794.17	\$ 2.75 B		0.35%
2	 Ethereum ETH	\$ 163.77	\$ 1.59 B		-2.36%
3	 EOS EOS	\$ 5.06	\$ 988.90 M		-3.25%
4	 Litecoin LTC	\$ 77.37	\$ 954.79 M		-2.48%
5	 Bitcoin Cash BCH	\$ 288.05	\$ 941.08 M		-1.27%
6	 XRP XRP	\$ 0.3055	\$ 370.42 M		-1.42%
7	 TRON TRX	\$ 0.02326	\$ 212.82 M		0.14%
8	 ZCash ZEC	\$ 62.83	\$ 175.96 M		-0.30%
9	 ZeroBank ZB	\$ 0.3119	\$ 163.61 M		-1.63%
10	 QTUM QTUM	\$ 2.54	\$ 151.82 M		-2.46%

To begin, **Ethereum [ETH]** for example is the major second coin that is operating on the Ethereum network but is operating independently of Bitcoin's blockchain. Since 2015, this one is becoming increasingly important because it allows to execute contracts involving complicated financial transactions. While in the traditional financial transaction such as future contracts or stock options, two parties contract a third party to conduct the transaction, with the Ethereum technology the third party is not needed anymore. In this way, the costs are reduced for both parties and there are no restrictions placed by a third-party mediator. Many well-known information technology and financial services firm such as J.P. Morgan Chase and IBM started to develop interest in the Ethereum network (Swammy, Thompson, & Loh, 2018).

Over the past years, Ethereum was following the course of Bitcoins (Figure 33) both upwards and downwards, mainly because of the general perception people have over the asset class.

Figure 33: Bitcoin and Ethereum: joined at the hip (Swammy, Thompson, & Loh, 2018).



The **EOS [EOS]** was created, in 2017, following an ICO (Initial Coin Offering) which is simply a crowdfunding in cryptocurrency, and more precisely in ETH. The launch of EOS provokes a tidal wave in the world of cryptographic currencies because this fundraising is unprecedented. The ICO is open to investors from June 2018. EOS is a protocol for creating decentralized applications using an improved blockchain. It is considered as a cryptocurrency competing with Ethereum because its technological process allows greater scalability: that is to say, it can easily adapt to a greater demand. 1 billion tokens EOS have been created and already more than 620 million have been distributed (Coin24, n.d.)

The **Litecoin [LTC]** uses script as proof of work and has faster transaction confirmations. Based on Bitcoin technology, Litecoin is one of the most popular cryptocurrencies, being considered by the most popular Coinbase trading platform. Created in 2011 by Charles Lee, a former employee of Google, who left the source code of Bitcoin (open source), to develop its own code, the Litecoin. This latter is a cryptocurrency distributed under free license. The blockchain on which Litecoin is based has been improved compared to the one of Bitcoin. This has helped to speed up the verification process and thus increase the speed of transactions, currently higher than that of its competitors. And transaction fees are much lower than those of Bitcoin. Litecoin is thus particularly intended for daily transactions. Like Bitcoin and most cryptocurrencies, Litecoin is produced in a limited number. The emission rate follows a geometric series that reduces a half every 840,000 blocks, eventually reaching 84 million Litecoins (Coin24, n.d.)

While the Ethereum is turned towards "smart contracts", **the IOTA (or MIOTA) [IOT]** is linked to connected objects, the "Internet of Things", which some describe as "fourth industrial Revolution". Created in 2015 by David Sonstebo, Sergey Ivancheglo, Dominik Schiener and Dr. Serguei Popov, IOTA is based on a technology that allows free and instant transactions between machines in the Internet of Things environment. IOTA differs from other cryptocurrencies in that it does not rely on the blockchain technology. In this way, there is no chain, no block, no minor intervening in the process. It is totally based on Tangle technology, fully decentralized, which allows transactions at no cost, secure, and instant. Its applications are numerous. The IOTA allows micro-transactions since there is no charge. Tangle technology on which the IOTA is based can also be used to transfer data, can be applied to set up electronic votes, or even serve as a basis for encrypted e-mail (Coin24, n.d.).

Ripple [XRP] has experienced strong growth in 2017. The Ripple has the specificity of having the support of banks: UBS, UniCredit or Santander already use its blockchain, which allows funds to be transferred at no cost. The ripple is a real-time gross settlement system in which settlement instructions for the transfer of funds or securities take place individually. It is a system that was launched in 2012 and supports any monetary system, including currency (coins and banknotes) and cryptographic currency. Ripple can be used to make money transfers around the world. For these international transfers, Ripple uses a pivot currency, the ripple, which is his own cryptographic currency. The principle of these international transfers is relatively simple. For example, for a transfer from France to the United Kingdom, the money is sent from the issuer's account to the account of an intermediary, also located in France. This intermediary sends the equivalent of this amount to the account of another intermediary situated in the United Kingdom, who keeps the ripples and sends the equivalent amount in pounds sterling to the addressee's account. Thus, the issuer will pay only the rate for a local transfer, since the money crosses the border in the form of ripples (Coin24, n.d.).

The **Peercoin [PPC]** uses a hybrid proof of work system and has an inflation rate of 1%. Peercoin was released in 2012. Peercoin is a crypto-money that targets reliability, so it does not require large computing power to maintain the network. Its main goal is to offer the most reliable virtual currency at a lower cost. Peercoin uses a combination of Proof-of-Work and Proof-of-Stake systems for block validation. Thus, the proof-of-work ensures the security of

the audit while the proof-of-stake will encourage members to keep their computing power for the network. On the opposite of Bitcoin, Peercoin does not have a maximum number of tokens defined. To avoid an excessive generation of tokens that could bring down its price, Peercoin auto-regulates its inflation of 1% per year, directly in its source code. This process therefore makes it possible to control the creation of money (Coin24, n.d.).

Bitcoin Cash [BTCS] is based on Blockchain, just as the Bitcoin. It was created due to some disagreements in the Bitcoin community. In fact, Bitcoin's blockchain is not able to handle a large number of requests and users without impacting the cost and speed of the transactions. To overcome this problem, a new version "Bitcoin Cash" was created. It uses the same blockchain process as the traditional Bitcoin but is now faster and transaction costs are cheaper. As Bitcoin's Blockchain was fully copied, all Bitcoin owners were given an amount of Bitcoin Cash equal to the amount of Bitcoin in their wallets. The most striking discussion about this cryptocurrency is that some people claim that Bitcoin Cash more accurately reflects the original Bitcoin principles. They accept Bitcoin Cash as the real Bitcoin. The discussion between Bitcoin Cash and Bitcoin advocates continues on platforms like Twitter and Reddit (Coin24, n.d.).

Namecoin [NMC] is the first cryptocurrency acting as a decentralized domain name system (DNS). Namecoin supports freedom of speech and seeks to make Internet more resistant to censorship. One of its main features for that is the ".bit" that allows to freedom, limits the espionage and hacking. For this reason, Namecoin is a real alternative to domain names. It is based on the bitcoin code and uses the same proof of work algorithm. Like Bitcoin, it is limited to 21 million coins. Unlike Bitcoin, Namecoin can store data in its own blockchain transaction database (Coin24, n.d.).

Today, thousands of cryptocurrencies with different functions and characteristics exist but not all are being successful, especially those with little innovation.

8.5. Cryptocurrency and the Governments: Practical Cases

The governments from all around the world are also responding to the growing popularity of cryptocurrencies.

8.5.1. Venezuela: Petro

On the 28th of August 2018, President Nicolás Maduro ordered Venezuelan banks to adopt his virtual currency, the *petro*, not decentralized this time. Venezuela is the first state in the world to have launched its own national cryptocurrency, caught in a serious economic and financial crisis. This was linked to the wish for Venezuela to bypass a financial system dominated by the United States but was without any real guarantee of success (Mourselas, McLellan & West, 2018).

The petro is backed by Venezuela's oil reserves. Each petro is normally backed by a barrel of the government's oil. Nonetheless, having a petro token does not give a right on a barrel of oil, but on the government for the previous day's price of a barrel of oil (Mourselas, McLellan & West, 2018). Therefore the person who has a petro can tell himself that this currency has a value, the one of oil price, which certainly fluctuates but which will not fall to zero like the bolivar.

Although Maduro claimed that the Petro had raised \$735 million shortly after its launch, some critics arose regarding the reliability of the petro and its backup, but he quickly reacted and explained that the Petro will have a good impact on the access of Venezuela to the foreign currencies and also get goods and services from abroad. He explained that the petro can be used in popular tourist destinations and along its western border such as Margarita Island, Los Roques, Urena and San Antonio del Tachira (What Maduro has said of Venezuela's Petro Cryptocurrency, 2018).

Not quite surprisingly for many, Reuters journalists visited Atapirire, a small town in central Venezuela in August, in a region that is supposed to guarantee the production of the 5 billion barrels expected. They found truly little drilling activity, dilapidated infrastructure, poor roads and a hungry population. They announced that the Petro is announced at a value that only exists in the government's imagination, that we cannot find anywhere. The agency found a small number of people who bought tokens during the pre-sale, but none of them want to disclose their identity and one of them claims to have been fooled. No store seems to accept petro to

date, and of the 16 marketplaces "certified" by Maduro, only Coinsecure, based in India, admitted to Reuters that it was working on introducing petro on its platform (Poireault, 2018).

8.5.2. Sweden

According to the Riksbank's website (2018) :

“The use of banknotes and coins is declining in society. At the same time, technological advances with regard to electronic money and payment methods are proceeding rapidly. The Riksbank is therefore investigating whether Swedish kronor need to be made available in electronic form, the so-called e-krona. No decisions have yet been taken on issuing an e-krona.” (E-krona, para. 1)

In 2017, the Riksbank, the Swedish central bank, revealed that it was working to launch its own digital currency called "e-krona". According to Stefan Ingves, governor of the Riksbank, the e-krona should be commonly used within three to four years. But, for safety's sake, it would not completely replace physical money. The **e-krona** is a digital iteration of Sweden's fiat currency, the *Krona*. Thus, it would have the same value of the standard Krona deposited in local banks or online (Adam, 2018).

The Riksbank's website has already published two project reports, one in September 2017 and one in October 2018. On the last report, we can find information about the need for an e-krona, the e-krona concept, the legal matters and consequences for monetary system and financial stability, the functions and technical solutions and finally the e-krona pilot project (Riksbank, 2018).

One of the main reasons of the need for an e-krona is that the use of cash continues to decline in Sweden. According to the Riksbank's survey in 2018, only 13% of the people paid for their last purchase in cash. In 2010, the number was 39%. This can be explained by the digital developments that Sweden is involved in and by the convenience and accessibility digital payments offer compared to cash payments. Within few years, Sweden can become a place where cash is not accepted as a general means of payment. If the use of cash declines, then the Swedish governments has to adapt itself to this situation and therefore propose the “e-krona” (Riksbank, 2018).

The e-krona is a digital central bank money which is issued by the Riksbank (no credit or liquidity risk), meaning that people will have a claim on the Riksbank, as for the cash. It will

be available 27/7/365 and will either be value based (stored in a card or an app) or account based (stored in a central register kept by the Riksbank). Furthermore, the difference with cash is the traceability. While with cash payments, people can still remain anonymous, with e-krona this is impossible, people are traced. E-krona can always be exchanged for other Swedish currency like cash or money in the bank accounts (Riksbank, 2018).

The report also displays responses to legal questions. On the one-hand, the value-based e-krona is considered as electronic money, e-money:

“Electronic money refers to an electronically... acquired monetary value that represents a claim on the issuer, issued for the purpose of exchanging it for funds in payment transactions pursuant to the Payment Services Act and which is accepted as means of payment by parties other than the issuer” (Riksbank, 2018, p.20).

On the other hand, the account-based e-krona refers basically to the banking activities as we know them today.

As regards to the monetary system and financial stability, the e-krona will have several consequences. The demand will depend on the e-krona's attractiveness compared to other means of payments; is it universally available? In the long term, holding an e-krona will cost even less than cash. In fact, even if cash has an implicit interest rate of 0 no matter of where the policy rate is set, it has transporting, storing and insurance costs. And it is not possible to have a non-interest-bearing krona while being attractive and available universally. The central bank therefore needs processes and as and when essential, to influence the level of demand in order to protect the economy, financial stability and offset recessions (Riksbank, 2018).

Regarding to the functions and technical solutions of the e-krona, this latter should at least have a comprehensive range of services with a simple, scalable and flexible platform. It should also be universally available, easy to use, performant. The e-krona should also boost the robustness on the payment market. Various e-identification solutions, ensuring security and reliability, should be available. On the one hand, the system should guarantee user integrity by presenting a payment option without anyone but the payer and the payee being able to see it. On the other

hand, the system also has to make sure to trace transactions in case of fraud or money laundering (Riksbank, 2018).

The Riksbank will continue to assess the e-krona whether it is for financial or legal aspects before eventually launching it (Riksbank, 2018).

8.5.3. Estonia

Estcoin is a national cryptocurrency that was proposed by the Government of Estonia in August 2017. Estonia was aiming to provide a framework to all questionable practices often observed when setting up ICOs. With the Estcoin, the problem faced by entrepreneurs, namely the difficulty of creating a business quickly and fully electronically, should find its solution. In short, this token should fluidify the system already set up by the e-residency, which allows many entrepreneurs from all over the world to open an office in Estonia.

However, in June 2018, many criticisms have been levelled mostly from banking authorities. Thus, Estcoin's plans were updated in order to not anymore peg its value to the euro, nor to be a national cryptocurrency but that to explore different possibilities that the blockchain technology offers like Estcoin could become the official currency of its e-Residency of Estonia program. As it will be limited to individuals under Estonia's e-Residency program, it cannot be freely exchanged and therefore cannot technically be considered as cryptocurrency (Laystary, 2018).

8.5.4. Turkey

Turkey, in the midst of an attack on its currency, first asked its citizens to use their gold to support the economy. Then, the head of the Turkish Central Bank announced that he believed that crypto-currencies can contribute to improving the country's financial stability. A working group has been appointed to quickly imagine the Turkish cryptocurrency ("Le "Turkcoin", 2018)

According to the Al-Monitor's article, Ahmet Kenan Tanrikulu, vice-president of the Nationalist Movement Party (MHP), has called for the creation of a Turkish-controlled national cryptocurrency called Turkcoin. The world is moving towards a new digital system: Turkey therefore wants to create its own digital system and its own currency before it's too late ("Le "Turkcoin", 2018).

Turkcoin could be useful for both tourism and trade. Many companies accept payment with crypto-currencies, and the number of customers using these currencies is increasing rapidly, the minister added. For the minister, opposing these currencies does not make sense - it's a national issue that requires a national consensus ("Le "Turkcoin", 2018).

8.5.5. South Korea

South Korea is considered a nation capable of the rapid adoption of new technologies. It is an integral part of culture, in the same way as croissants or wine are in France. In 2019, it was one of the first to offer 5G to its inhabitants. In fact, the Asian region has also been one of the early adopters of the smartphone revolution. Today, more than 80% of the population owns one.

While in France, or in the United States, cryptocurrencies are only a niche market, in South Korea, it is almost a mass phenomenon because its inhabitants are extremely involved in the sector. In addition, companies from the Republic of Korea are looking to integrate cryptometers into their offerings. For example, Samsung, via its Galaxy S10, offers a crypto wallet directly embedded in the smartphone. Local companies use the fact that Koreans have long been accustomed to making digital payments to launch this type of service.

In fact, in July 2017, the BTC was legalized at the national level, which helped to accelerate this movement. During the bull run at the end of 2017, South Korea alone accounted for 30% of crypto active trading volume.

The government is becoming aware of the crypto-mania that is seizing the country and taking steps to protect its citizens. For example, it prohibits anonymous trading to combat money laundering. South Koreans are no longer as present on the market today as they were in previous periods (Guillaume, 2019).

8.5.6. Japan

On the 1st of March, 2019, Japan has launched J-Coin Pay with the purpose to make Japan cashless without the use of cryptocurrency. It is a smartphone based digital wallet, using a QR code to make payment. The app lets customers to buy goods, send and receive transfers, make payments, and perform other financial transactions related activities, all on their smartphones. Customers can also move funds from their J-Coin Pay account to their deposit account for free.

The service is available on iOS and Android. It was quite surprising that blockchain has not been used in the development of the J-Coin Pay (Mobilepaymentstoday.com, 2019).

8.5.7. Dubai

Thanks to a partnership between the blockchain payment provider Pundi X, Ebooc Fintech & Loyalty Labs and emcredit - Dubai's Credit Bureau, digital payments via emcash will be possible for school fees, governments utilities, telecommunication, bills and retail purchases with a digital currency. It will therefore be the first city to offer blockchain-based payment systems (Dubai to release digital payments on pundi X technology, 2018).

8.5.8. Switzerland

Switzerland is home to many organizations that are working on blockchain development worldwide, such as the Ethereum Foundation, and many businesses already allow e-currency payments. But the country wants to go further. In an interview with the Financial Times, Romeo Lacher, the head of the Swiss Stock Exchange seriously considered the creation of a cryptocurrency franc. On the same line as Sweden and its e-krona, Lacher believes that an e-franc controlled by the SNB, the Swiss National Bank, would be an undeniable advantage for local trade as it will be risk-free. He also considers that if the central banks do not launch digital versions of their currencies, they will hand the control of their payment systems to an uncontrolled and potentially dangerous private sector (Atkins, 2018).

8.5.9. Belgium

What about taxation in Belgium for cryptocurrencies? Belgium does not yet have specific tax rules for virtual currencies. So what is their tax treatment?

In 2015, the European Court of Justice confirmed that Bitcoin (and, by analogy, all cryptocurrencies) is a currency. For example, the purchase and sale of Bitcoins is therefore exempt from VAT (Homans, n.d.).

Capital gains realized on the sale of Bitcoins by a Belgian resident are, in principle, exempt from income tax if they are realized outside the professional context and are part of the normal management of a *good father*². To determine whether an operation is part of the normal management of a *good father*, it is necessary to analyze each case separately. Thus, it has just been considered that a capital gain realized by a Belgian resident who had developed an

² Bon père de famille

automatic application for the purchase and sale of Bitcoin was outside the scope of the management of a *good father*. This capital gain would thus be taxed at the rate of 33%. If the capital gain realized on a virtual currency is taxable, the Belgian taxpayer must include it in his annual tax return. The Belgian tax administration encounters difficulties in tracing transactions carried out on cryptocurrencies platforms that are most of the time foreign and unregulated (Homans, n.d.).

Upon the death of a Belgian resident who owns cryptocurrencies, his heirs will be subject to Belgian inheritance tax on these cryptocurrencies. As a reminder, the rate of these inheritance taxes is progressive and can reach up to 30% in direct line and up to 80% in other cases (depending on the relationship between the person granted and the deceased and the region where the deceased resided). To avoid this inheritance tax, it is possible to transfer virtual currencies during your lifetime to your heirs. This transmission can take various forms, including donation or the use of life insurance. The use of the insurance mechanism may, in certain cases and under certain conditions, make it possible to mitigate the risk of taxation on capital gains realized when selling crypto-currencies (Homans, n.d.).

8.6. Conclusion

Today, cryptocurrencies have become a global phenomenon known to most people. After the announcement of the first version of Bitcoin, a new electronic payment system that uses a peer-to-peer network, fully decentralized, with no server or central authority, created by an anonymous person or group, thousands of cryptocurrencies with different functions and characteristics appeared but not all are being successful, especially those with little innovation. Many countries are working on launching or have already launched their own cryptocurrencies, some of them seems promising like in Sweden, Switzerland or Japan while some of them completely failed like Venezuela.

Part II: The Future?

1. Are we going towards a cashless society?

Nowadays, we are going towards a world where electronic payments are becoming increasingly important. Buying bread with coins, withdrawing cash at the supermarket checkout or ATM, paying drinks in cash, ... All these activities are tending to disappear in our developed world. At the present times, we are talking about *contactless payment* and *instant payment* done from the mobile phone. Even when it comes to sharing the bill in the restaurant, it is possible to make arrangements with people thanks to the Bancontact application. Since the arrival of online banking, the number of people using physical branches, especially for small everyday transactions is decreasing consequently. Agencies are closing and working more closely with technology consultants to improve their online presence. RTBF (2019) has revealed that in Belgium, BNP Paribas Fortis announced on Friday the closure of 267 branches by the end of 2021. No doubt that others from the financial sector like ING or AXA are following the same trend.

So, will we ever get to a cashless society? This is almost already the case in the Nordic countries, international leaders in electronic transactions. In Europe, countries such as the Netherlands and Estonia have followed suit but are still far behind. According to the latest figures (2017), Italians pay by card on average 46 times a year, Germans 54 times, Frenchman 185 times, Belgians 166 times, Dutchman 250 times and Swede 331. In Sweden, the believers can even make donations to the Uppsala Cathedral by using their bank cards (Keytrade Bank, 2019).

The advantages of a cashless society are first of all and most importantly, any electronic transaction leaves a trace. If there is less cash in circulation, a public trust will emerge because many doors will be closed to undeclared work and fraud. It also reduces the risk of blasting, hold-ups, burglaries, robberies, theft... Where, cash is costly. According to an ECB study (as cited in Keytrade Bank, 2019), we pay a high price for the cash and the costs are mainly associated with design, equipment, printing, secure transport and storage under high surveillance, security and handling of bank branches, infrastructure (from presses to vending machines) ... Of course, electronic payments are not free either. They require terminals, servers,

networks, security measures and electricity. But the costs per transaction are considerably lower. In fact, the more electronic transactions there are, the lower the social burden of cash.

Are there also disadvantages on giving up cash altogether? There is a chance that companies can sell electronic payment data and have access to the consumption preferences of customers, which will lead to a loss of trust in digital by society. Another disadvantage is that a cashless society requires a 100% reliable energy supply network and systems. In the event of a default, the payment history can probably be recorded locally on a temporary basis, but the situation will quickly become untenable. Furthermore, the people that do not have a bank account and elderly or disadvantaged people may have difficult access to a digital account. However, in Sweden, the Riksbank that is working on the e-krona is considering the accompaniment of these persons particularly by developing of digital financial solutions adapted to them. This is the case of many other European countries of as well, and we think it is quite natural as it is impossible to avoid the technological advances.

We believe that the past shapes in some sort the future and that the digital society is a logical result to the history of money. Certainly, we are not at the best form of the digital society and there is still room for improvement, but we already tend to use less and less cash. Therefore, we consider that a cashless society is being created on top of a society that was formed on a *cashbased* economy, and that the disadvantages are to consider and potentially offset. The speed of this transition depends on many factors such as technological advances in the different regions of the world, their adaptability and their history but the transformation to a cashless society is on its way. From cowry shells to digital accounts, we have come a long way, a lot has been done but a lot still needs to be done.

2. Are the monetary ecosystems sustainable?

2.1. Different Point of Views on Monetary Ecosystems

2.1.1. F. Hayek: Fight of Currency, the winner has gold behind it

F. Hayek is an economist from Vienna that was born in 1899 and died in 1992. He won the Nobel prize in 1974 (Investopedia, 2018).

F. Hayek criticizes J. Keynes and in particular the economist view that the investments of the states for the sake of the economy would ensure the prosperity of the economy. He explains that previous economist had warned against the intervention of the state. F. Hayek goes through J. Keynes theories concerning the unemployment. He also explains that except for the 200 years ruled by the gold standard (described earlier in this thesis), nearly all governments used their power to issue more money that they were allowed to in order to rob the common people. He adds that even though governments are elected by the majority and therefore should serve the majority, in facts this issuance of money only serves the government and their favorites. Moreover, he feels that there is no reason to believe that the government using their sovereign right to manage money gives a better currency to the citizens than a currency that would be handled by the citizens themselves (Hayek, 1976).

However F. Hayek sees no problem with the issuances of money from governments, but he disagrees with the idea that governments could limit some currencies and the exchange rate of such currencies on their territory. He is strongly in favor of restricting all forbidding on the behalf of the government concerning foreign/different currencies (Hayek, 1976). Governments do not appreciate additional currencies as they are not legal tenders meaning that the taxes cannot be paid with it.

If multiple currencies were to work in the same economic system, people would really quickly deny the national currency when they feel that the state would depreciated strongly. They will rather use a currency in wish they have more trust. According to F. Hayek, the employers would also rather pay the wages in a currency that they trust (Hayek, 1976).

F. Hayek concludes by saying that if the people were free to pick any currency, most probably they would pick the currency that is the most reassured by the gold standard (Hayek, 1976). This, in other words means, that the strongest currency would be the currency that is assured the most by gold (France Culture, 2019). Of course, in the present system this relation to gold does not matter, but F. Hayek simply highlights that ecosystems are good for the citizens

2.1.2. B. Lietaer: an Ecosystem of currencies, increased resilience

B. Lietaer explain that a cause for structural instability of the monetary/financial system is the monetary monopoly of the states. And that a variety of money is not a perturbator elements but a necessary, while not perfect, condition for stability (Lietaer, 2013).

Meanwhile, B. Lietaer states that, in many systems (such as a biomass or the financial system), there are two main poles: efficiency and resilience. These two poles are mutually exclusive. For instance, an animal feeding from only one type of plant being found in abundance is in a remarkably effective system but the animal has very few resilience in case if the plant gets sick and disappears. The same reasoning applies for financial systems: a unique plant (currency) has no resilience in case of a crisis. The idea to have multiple currencies applies on the national level as well as the international level. The choice to have only one currency is based solely on effectiveness and not at all on resilience (Alternatives Economiques, 2009).

As mentioned before, in Switzerland, a dual system of currencies has been put in place in the 1930's. This money is only usable between firms and cannot be exchanged against other currencies. It integrates the classic Swiss monetary system. In case of crisis, the amount of WIR increase to compensate the hit on the classical currency. When the economy is booming, the classical Swiss Franc is favored as it is more liquid, being exchangeable anywhere in the world (Alternatives Economiques, 2009). The viable way for the financial world is therefore truly clear: diversified currencies should be used at the same time in the economy and the agents producing them should be diversified as well (Lietaer, 2013).

2.2. Conclusion

Both F. Hayek and B. Lietaer agree that multiple currencies within a society is beneficial. We have seen it throughout Switzerland and its WIR but also throughout Brazil and the Banco

Palmas that developed the local economy by providing marginalized populations with access to banking services, such as micro-credit for production or consumption.

Although, F. Hayek specifies that people would tend to use the currency in which they have the most trust. B. Lietaer explains that it increases the system's resilience to have multiple currencies. This shows us that systems with diversified currencies are not only possible but also favorable. The WIR used in Switzerland is a living example of the advantages that such a dual currency can offer, because it is able to offset the negative effects of a national currency in case of recession.

3. What are the advantages and drawbacks of cryptocurrencies?

In order to become aware of all aspects of cryptocurrencies, we will analyze, in a general way, their advantages and drawbacks. Today, there are different types of cryptocurrencies, so the list may not apply to all.

3.1. Advantages

3.1.1. Decentralization

The cryptocurrency is a decentralized computer network, transactions are peer-to-peer between each user, their control works through a blockchain, serving as a public financial transaction database. The main advantage of this decentralization is that the system works entirely by connecting every user to each other. Thus, even if someone on the network would turn off their computer or lose internet access, the other users would still be able to maintain the network. This is why the cryptocurrency has the specialty of being “trustless”, because nobody has to trust anybody else for the network to work.

3.1.2. Immutable

Immutability in regard to cryptocurrency has three characteristics; *i)* almost impossible to rewrite history, *ii)* impossible to move funds of anyone else, *iii)* all transactions recorded on the blockchain. Today we expect our banks to protect our money and not manipulate them. In case of a fraudulent activity with our banking account, we trust our bank to change it and correct the situation, this is not needed for a cryptocurrency.

3.1.3. Limited treat

The blockchain that uses the blockchain technology to store the online ledger of all the transactions that have ever occurred using a certain type of cryptocurrency provides a data structure to this ledger that limits the threat from hackers. As mentioned in the part 8, every new block generated are verified by the cryptocurrency miners, making it impossible to falsify the transaction histories.

3.1.4. Quick and No Fees

Transfers of cryptocurrencies are done in about ten minutes, the time that the transaction is validated by minors (people who produce cryptocurrency). There is no intermediary, no banking organization that intervenes. There is therefore very little charge or no credit cards or

bank transfers. It takes less time than the banking system nowadays which can take up to five open days for transfers, especially international ones.

3.1.5. Safe Data

It is impossible to steal and use data of other users, on the contrary to the current credit card systems. Indeed, while performing a transaction, two keys are needed; a public key and a private key only the user know.

3.2. Drawbacks

3.2.1 Crash

As there is no central repository, a cryptocurrency balance can be deleted by a computer crash if there is no backup copy or if someone uses its private keys to control its access.

3.2.2. Volatility

Today, cryptocurrencies are not accepted across all countries of the world, prices are based on supply and demand, thus the rate at which the cryptocurrency can be exchanged for another currency can float a lot and even become a speculative bubble.

3.2.3. Connexion

As for our digital accounts in the traditional banks, cryptocurrencies depend on an internet connexion. In the case of an internet connexion problem, cryptocurrencies will be inaccessible.

3.3. Conclusion

Cryptocurrencies have many advantages especially when it comes to effectiveness, speed or trust establishment but in the meantime, they rely mostly on the internet, which, in case of default, would block all access to all users.

4. Are cryptocurrencies a possible future for European governments?

In this part, we will discuss whether the cryptocurrencies are a possible future for governments by analyzing the features defining the cryptocurrencies in the context of a cryptocurrency depending on the state. It is important to note that, we assume that the state is trustworthy on financial matters. Indeed, along with history many cases showed a lack of consideration at best and actual fraud at worst on behalf of the state towards the citizens, for example with the assignats.

In the past, when an individual needed to make a loan, she/he would go to the banker who gave him/her a bill of exchange for the gold he/she deposited in the safe. As time went on, the banker began to issue more bills of an exchange than the gold available in his vaults, because not all the gold deposited by the savers was claimed simultaneously. Today, our banking system works on the same principle. When a banker makes a loan, he creates a currency that he does not have, thanks to a simple accounting entry. This currency then circulates in our economy and is even multiplied by other banks loans. On the one hand, when the number of credits increases, the price of goods also increases, and this leads to inflation. On the other hand, if there is not enough money in circulation, then prices then have to readjust and decrease, and this leads to deflation. A deflation results in margins fall and general decline in economic activity. It is therefore essential to control the currency in circulation in our economy: this is the role of the central bank, via the loans granted by the banks. When a bank needs liquidity, it uses the central bank, which lends it an interest rate called the key rate. This rate has a direct impact on the interest rates on loans. The lower the interest rates, the greater the demand for credit: banks then inject more money into the economy. Conversely, the higher they are, the lower the demand for credit: banks then inject less money into the economy. Today, to prevent all forms of crisis, central banks require all commercial banks to deposit a percentage of the deposits they collect into their account, for the case of the European Central Bank, it is 1%. The lower the reserve requirement rate, the more credit banks will be able to grant (Dessine-moi l'éco, 2012).

The Chicago Plan exactly criticized this monetary system, but already back in the 20s. It states that money can only be a stock of public goods and not a variable flow generated by commercial banks, which it accused of secretly printing money (Colmant, 2019). The aim of the Chicago

Plan is to suppress the cash flow (the cash flow being the circulation of money caused by the credit multiplier effect of the commercial banks) of by limiting the quantity of money to its stock. The Chicago Plan is designed to nationalize the currency and dispossess commercial banks of their manufacturing capacity by requiring that deposits be 100% guaranteed by currency issued by the Federal Reserve, and by ensuring that the financing of new bank credit could not be financed by the creation of new deposits, by commercial banks (International Monetary Fund et al., 2012).

The IMF in its report showed that the application of the Chicago plan would lead, on the one hand, to a system limiting uncontrolled debt and therefore limiting the risk of bank problems. On the other hand, the banks would be able to concentrate on their expertise (invest in projects with a high expertise in risk management). The IMF also states that it would help to control the inflation. This very inflation being influenced strongly by the credit multiplier effect. In such a system, the commercial banks would be simple intermediate deprived from their right use the credit multiplier. The central bank and commercial banks would be integrated, they only currency that could be used would be the central bank's (Colmant, 2019).

As above-mentioned, economists generally agree on the three essential functions of money, already specified by Aristotle in antiquity, namely: means of exchange, unit of account and value reserve. As a mean of exchange, for now, the use of cryptocurrencies in daily commerce is rather anecdotal. They are not legal tender in the nations, this means they are not accepted by every commerce and their use are rather speculative. Then, the high volatility of the price of cryptocurrencies prevent them from becoming a unit of account. Finally, for the sake of value conservation, currency must be easy to keep safe, especially against theft or loss, central banks are currently working on that aspect. While cryptocurrencies offer this security thanks to the blockchain technology, in case someone lose his access code, he also loses his key to enter his account and so his right to manipulate his currency.

Intuitively, a cryptocurrency created by the governments could be the digital version to the establishment of the Chicago Plan of yesterday but then we see some obstacles to that. Cryptocurrency in its essence is an instrument that aims to be independent of an institution by being controlled by the community. Blockchain is the mechanism that allows this community control, thanks to the miners which validate the different transactions. This is the

decentralization aspect, cryptocurrencies are very secure as soon many people are involved in it. A government currency controlled by blockchain technology as only currency within a country could determine and secure the level of the money stock. But, by definition, this system is not decentralized. We can argue that the problems associated with centralized currency, could also emerge with the blockchain, except that this time every transaction are supposed to be transparent. That is why we think it will not be a cryptocurrency but a virtual/ digital currency using the blockchain technology and launched by the governments, which, through central banks, could issue or destroy money through digital currencies, to establish their monetary policy to exert economic influence. This time they can even track all the money circulating inside or outside the country and as they are trustworthy, they can combat fraud, terrorism, anonymity, ... In this scenario, the commercial banks, as explained above, could disappear. Nevertheless, a system where the government would be the only institution issuing money can seem odd. But in early history, examples can be found where the bank system was controlled nearly fully by the state (The banks of Napoleon). The danger with such a system is that if the state is not trustworthy, it can rob the citizens in one decision. A system where a state would handle alone a cryptocurrency could also represent a backward step also because the government would access to all transactions and seriously question the security and freedom of the citizens. But in this work, we have taken as a parameter that the state would be trustworthy and therefore we exclude by definition such a scenario.

We have seen that, from time immemorial, human has never stopped exchanging, bartering and sharing. Initially, the sole purpose was to exchange goods of equivalent value and obviously as soon as humankind wants it, he can do it, whether by using the governments money or its own community money. The WIR in Switzerland or the Banco Palmas both successively created complementary currencies to the national ones, once again to oppose to this controlling institution, the government. Cryptocurrencies, according to us, may, therefore, be a digital version of complementary currencies, which guides us to another lead: in the short term, what about a national currency accompanied by a national cryptocurrency?

If the governments launch their own cryptocurrency while keeping today's monetary system, they can only offer an "option effect". People could then choose whether to use the national currency, for example, the euro, or the national virtual/digital currency using the cryptocurrency technology. We have seen in the past that a dual system of money is in many

cases advantageous as it is able to offset the negative effects of one currency on the other. In this case, many illegal currencies could also disappear and while the governments could always have an eye on the economic activity, it could also influence the monetary system, to the best of their ability. We have seen that in Sweden, an e-krona is being studied to ensure the control of payment services to the governments. In fact, the Swedish society already sees that more private agents are issuing and controlling payment means and therefore the risk eroding basic trust in the Swedish monetary system could appear. The Riksbank, Sweden's central bank, is aiming to neutralize or mitigate these problems by launching its own e-krona. In that way, both the government and private agents will keep their impact on the economy. Likewise, Switzerland is also considering launching its own e-franc for a cashless payment system under the control of the central bank.

Incidentally, we have also seen from Gresham law that the bad money chases away by the good one. But we have seen that with the WIR in Switzerland example that this law does not hold when the currencies are not used for the same purpose (example: the national Swiss franc is used by all while the WIR is only used by the small and medium sized enterprises). This phenomenon is further developed in section 2.1.

Final Conclusion

In the first part of this work, we have studied, analyzed and discussed the money throughout history to understand better the monetary system we are involved in today. First, we understood that money has three main functions since its creation: means of exchange, unit of account and value reserve. Secondly, we have studied different economic views that emerged along with history, going from the wealth of creation to the impact of issuing money on the general price level. Thirdly, we have researched different objects that have served as currency. All these objects have in common that they hold an intrinsic value. They hold value as a utility (ex: salt, cacao beans...), as a symbol (the Yap stone) or as wealth (precious metals). Fourthly, we have studied John Law's idea: people would carry the representation of the wealth rather than the intrinsic value itself. However, this system is dangerous as the temptation is high for the states to abuse their issuing right which lead to inflation crisis. Fifthly, we have seen that under the impulsion of Napoleon the 1st, a common mean to trade (coins of different countries with the same amounts of precious metal) was installed on the principle of the bimetallism. Unfortunately, this system failed following the Thomas Gresham law. Later on, the gold standard was installed and worked wonderfully thanks to the price-specie-flow mechanism of David Hume. Unfortunately, this system only works as long as the countries part of the system keep the balance between the gold in the vault and the notes/coins circulating in the system. Sixthly, we have comprehended that the gold standard became the gold exchange standard before disappearing totally as an international tool with the Jamaica accords (1976). But the will to be able to trade internationally did not vanish with the use of the gold. Moreover, countries after the wars were willing to unify to avoid such catastrophes. Those European countries unified first under the European Monetary System and then under the Euro. Our actual banking system works with a credit multiplier meaning that the commercial banks create money. This system is supposedly under control as the central banks regulate it with their directional interests. Yet, we have seen that states can easily give up to the temptation, it goes the same way for private banks. The 2008 crisis was caused by a lack of care/prudence on behalf of the banks and as the all world is interconnected it had repercussions everywhere. After this historical review, we have understood that no perfect system has been found yet on monetary and financial matters. Indeed, the first form of notes (such as in china) do have as inconvenience that the monetary mass is limited which limits the trades. Afterwards, we have explored different types of complementary currencies, which are not national currencies but are used based on agreement between the parties exchanging the currency. We have seen that

the WIR in Switzerland, mostly used among small and medium-sized Swiss companies, is a crying example of success. Today on the door of a shop or restaurant, for example, it is not uncommon to find a sticker indicating that the WIR is accepted. The WIR is used when the Swiss Franc is in the storm. This shows that in terms of classical currencies, an ecosystem is functional with a government money and a bank money. Besides the WIR, other complementary currencies have shown a success story; Banco Palmas in Brazil, RES in Belgium, ... Last but not least, we have studied cryptocurrencies, this global phenomenon known to most people. Quickly after the announcement of the first version of Bitcoin, its price rocketed and thousands of cryptocurrencies with different functions and characteristics appeared but not all are being successful, especially those with little innovation. Today, many countries are working on launching or have already launched their own cryptocurrencies, some of them seems promising like in Sweden, Switzerland or Japan while some of them completely failed like Venezuela.

In the second part of this work, we have investigated if cryptocurrencies could represent the next step for governments, in view of the history of money. We have reached the answer to our problematic.

The answer to our Problematic

To establish our answer to the problematic, we have first of all elaborated the cashless society and the trends of today: European governments, and especially the Nordic ones, are getting closer and closer to a cashless society. Secondly, we have seen with H. Hayek and B. Lietaer that monetary ecosystems are beneficial for economies. We have learned from B. Lietaer, a Belgian economist, that the WIR in Switzerland has a different purpose than the Swiss Franc. It is used only between companies allowing them to keep trading even if the Swiss Franc goes down. Therefore, we have also concluded that a dual currency within a country can only be good, because the negative effects of one could be offset by the other and vice-versa. Then, we have investigated the different features of the blockchain to finally consider the idea of a cryptocurrency launched by a government. Governments remain skeptical towards cryptocurrencies, as these types of currency are, by nature, decentralized (in complete opposition with the regalian right to issue currencies). Moreover, governments want their citizens to use their national currency, as it is the only one that they control, as a legal tender. But in the meantime, banishing those cryptocurrencies is out of the question as the Blockchain

technology represents a giant step in term of technology. The blockchain technology allows the financial system to be controlled and secured by a community or a state.

We understood blockchain has a big role to play in our society and that governments would eventually end up using it, as it is impossible to ignore it. Thus, we explored two different scenarios concerning the launching of a digital/virtual currency using the blockchain technology. The first one being the scenario where the “(crypto)currency” becomes unique currency in the system. The second scenario sees the “(crypto)currency” as an additional currency, an alternative for the citizens. In both cases, the cryptocurrency would not be a cryptocurrency anymore but a digital currency, because it will not be decentralized. Indeed, the fact that the “community” would be able to have a surveillance on all transactions would mean that the cryptocurrency would lose its “crypto” side. Indeed, “crypto” in Greek means secret or hidden. This (crypto)currency would then follow the blockchain technology but lose its decentralized and mysterious essence.

Scenario 1: The “(crypto)currency” (digital currency) becomes the unique currency in the system

In such a scenario, it is possible to imagine that the financial system could function without the commercial banks. Indeed, the “loans make deposits” phenomenon would disappear as the commercial banks will no longer be needed in their actual shape. This would lead to the Chicago Plan defended by I. Fisher, but in a more modern and digitalized way. It would lead to a system where money would only be issued by the state and not by commercial banks. This would translate as a stock of money handled by the state. All transactions would be traced in the system thanks to the blockchain technology and the state would inflate and deflate the monetary stock as needed. But this scenario, to be a step forward, has to hold on the condition that the state is trustworthy (and we saw that in history the state often reveals itself unworthy of such a trust). Therefore, we consider that, especially because of the general defiance towards the state that has been diffusing in our society, (expressed by the *gilets jaunes* movement among others) it is very unlikely that this path would be viable in a near future?

Scenario 2: The “(crypto)currency” (digital currency) is an alternative to the national currency

If a cryptocurrency is launched by a government as an additional currency and if it is done with enough clairvoyance and care, the result could be close from the one of the WIR in Switzerland. The people will have the option to choose between the national currency or the national

cryptocurrency and therefore other harmful cryptocurrencies will disappear (as the government's "(crypto)currency" would be considered more trustworthy than the others).

As explained by B. Lietaer, ecosystems of cryptocurrencies lead to a higher resilience. The fact to have multiple currencies in one system is healthier and has already started. Many local currencies have already emerged in many places around the world. A "(crypto)currency" as an alternative to the national currency would lead to an ecosystem with the advantages a being able to track all transactions. We imagine that if the national currency is going down, the (crypto)currency can offset the negative effects of it and vice versa because having a dual system of currency is able to offset the negative effects of one currency on the other. Obviously, the (crypto)currency, as well as the national currency, will have a legal tender and thus would be even used to pay debts. Of course, a major drawback would be the "big brother" consequence of a state able to track all transactions. Definitely, further studies must be carried out to determine the maximum number of cryptocurrencies, to avoid hyperinflation, as for example the Bitcoin which is limited to 21 million units. But in the scenario where the state is trustworthy or at least trusted enough by the citizens to the extent to have an additional currency (not a solely new currency), we believe that this solution could be viable in a near future, as it will give the citizens the option to chose between "two national currencies".

Limitations

The theory and analysis to understand if there is a potential future for governments to launch their own cryptocurrencies has certain limits.

To begin, there have been thousands of different objects used for trades therefore we made the choice to study some of the outstanding objects that appeared along history. We reduced our scope in terms of numbers concerning the objects. Regarding the banking and fiduciary system, we have also reduced our scope to the Occidental world. More specifically on countries close to Belgium or with which Belgium was involved in agreements (such as the USA).

With regard to the subject of the cryptocurrency, we understand it is quite recent even though it has started long before the buzz around the bitcoin. Nonetheless, there is no as much literature as there is for other subjects. We do not know also the impact of cryptocurrencies in the long run, on ecology or law for example. Concerning our analysis, as no states have yet launched a cryptocurrency that has been trustworthy, we have to rely on our assumptions. The literature around cryptocurrency also was a weakness point in this thesis, as it is a new phenomenon.

Finally, concerning our answer to our problematic, we are only left with our suppositions and assumptions concerning what would happen in such a scenario.

Bibliography

A. Currot, N. (2016). ADAM SMITH'S THEORY OF MONEY AND BANKING. SAE, (47). Retrieved from https://sites.krieger.jhu.edu/iae/files/2017/04/Curott_Smiths_Theory.pdf

Alternatives Economiques. (2009). Bernard Lietaer | 1001 monnaies. Retrieved May 14, 2019, from <https://1001monnaies.wordpress.com/tag/bernard-lietaer/>

Atkins, R. (2018). Switzerland's stock exchange chairman calls for 'e-franc'. FT.Com, Retrieved from <https://search-proquest-com.proxy.bib.ucl.ac.be:2443/docview/2121966316?accountid=12156>

Avebury, M. Lord. (1902). A Short History of Coins and Currency. London, England: John Murray, ALBEMARLE ST.

Banque National de Belgique. (n.d.). Le sel, l'or blanc? — Musée de la Banque nationale de Belgique. Retrieved November 13, 2018, from <https://www.nbbmuseum.be/fr/2007/08/salt.htm>

Banque Nationale de Belgique. (2012, February 1). Les assignats : monnaie de la Révolution française — Musée de la Banque nationale de Belgique. Retrieved November 13, 2018, from <https://www.nbbmuseum.be/fr/2012/02/revolution.htm>

Banque Nationale de Belgique. (2019, April 18). Faillite de la société RES Prepaid BVBA | nbb.be. Retrieved April 25, 2019, from <https://www.nbb.be/fr/articles/faillite-de-la-societe-res-prepaid-bvba>

Banque Nationale de Belgique. (n.d.). Le premier billet de banque européen, un produit suédois — Musée de la Banque nationale de Belgique. Retrieved November 11, 2018, from <https://www.nbbmuseum.be/fr/2008/04/cradle-european-banknote.htm>

Barach, P. (2016, August 25). The Island of Yap and The Idea of Money. Retrieved November 12, 2018, from <https://medium.com/the-mission/the-island-of-yap-and-the-idea-of-money-9f570421d854>

Barber, T., & Wassener, B. (2002, Feb 27). The euro comes into its own: The euro becomes sole legal tender in the eurozone after tomorrow, capping an extraordinarily smooth changeover, report bettina wassener and tony barber: London edition]. Financial Times. Retrieved from <https://search-proquest-com.proxy.bib.ucl.ac.be:2443/docview/249094205?accountid=12156>

BBC, & Poole, R. (2018, May 2). The tiny island with human-sized money. Retrieved November 12, 2018, from <http://www.bbc.com/travel/story/20180502-the-tiny-island-with-human-sized-money>

Berend, I. T., Nguyen, A., & Servais, P. (2008). *Histoire économique de l'Europe du XXe siècle: Economic Regimes from Laissez-Faire to Globalization*. Bruxelles: De Boeck Supérieur.

Bitcoin ATM Map. (n.d.). Retrieved May 15, 2019, from <https://coinatmradar.com/>

Bordes, C. (2009, January 14). *L'île à la monnaie de pierre* (part 1). Retrieved November 11, 2018, from <http://antisophiste.blogspot.com/2009/01/ile-la-monnaie-de-pierre.html>

Bowman, J. S. (2000). *Columbia Chronologies of Asian History and Culture*. New York, USA: Columbia University Press.

Buy Bitcoin Worldwide. (n.d.). *Cours Bitcoin*. Retrieved May 5, 2019, from <https://www.buybitcoinworldwide.com/fr/cours-bitcoin/>

C. Rule, J. (1996). *A Career in the Making: The Education of Jean-Baptiste Colbert, Marquis de Torcy* (Rev. ed.). Retrieved from <https://search.proquest.com/openview/bd565a08068aed33dcde95dcbadd0187/1?pq-origsite=gscholar&cbl=1819160>

Catalogue Général des assignats français. (n.d.). *Instruction sur les faux assignats de 250 et 125 livres - doc-004 - Catalogue général des assignats français*. Retrieved February 2, 2018, from <http://assignat.fr/4-faux/doc-004>

CEE. (n.d.). Retrieved April 3, 2019, from <http://www.hist-geo.com/cee.php>

Coin24. (n.d.). *Présentation et définition de la crypto-monnaie Eos (EOS)*. Retrieved May 5, 2019, from <https://coin24.fr/eos/>

Coin24. (n.d.). *Présentation et définition de la crypto-monnaie Iota (IOT)*. Retrieved May 5, 2019, from <https://coin24.fr/iota/>

Coin24. (n.d.). *Présentation et définition de la crypto-monnaie Litecoin (LTC)*. Retrieved May 5, 2019, from <https://coin24.fr/litecoin/>

Coin24. (n.d.). *Présentation et définition de la crypto-monnaie Ripple (XRP)*. Retrieved May 5, 2019, from <https://coin24.fr/ripple/>

Coin24. (n.d.). *Présentation et définition de la crypto-monnaie Peercoin (PPC)*. Retrieved May 5, 2019, from <https://coin24.fr/crypto-monnaies/dictionnaire/presentation-definition-de-crypto-monnaie-peercoin-ppc/>

Coin24. (n.d.). *Présentation et définition de la crypto-monnaie Bitcoin Cash (BCH/BCC)*. Retrieved May 5, 2019, from <https://coin24.fr/bitcoin-cash/>

Coin24. (n.d.). *Présentation et définition de la crypto-monnaie Namecoin [NMC]*. Retrieved May 5, 2019, from <https://coin24.fr/namecoin/>

Colmant, B. (2017). L'euro: une utopie trahie?. Waterloo, Belgique: Renaissance du livre.

Colmant, B. (2018). De l'or desempliers aux cryptomonnaies: Histoires d'économie (Ed. rev.). Limal, Belgique: Anthemis

Colmant, B. (2019). L'histoire du plan monétaire de Chicago. Belgique : Académie royale de Belgique.

Colmant, B. (2012). Des monnaies et des Dieux. L'Echo. Retrieved April 23, from <https://lechoblogs.typepad.com/colmant/2012/11/dieu-la-monnaie-un-aggiornamento-mon%C3%A9taire-ou-armageddon.html>

Colmant, B. (2016, March 11). 'La BCE solde l'État-providence'. Retrieved May 1, 2019, from https://trends.levif.be/economie/banque-et-finance/la-bce-solde-l-etat-providence/article-opinion-477415.html?cookie_check=1559547555

Colmant, B. (2016, March 31). Et si le scénario économique était une stagflation ? Retrieved March 3, 2019, from https://trends.levif.be/economie/politique-economique/et-si-le-scenario-economique-etait-une-stagflation/article-opinion-484451.html?cookie_check=1559547512

Colmant, B. (2018, September 25). Quand la monnaie fond. Retrieved May 5, 2019, from <https://www.lecho.be/dossier/brunocolmant/Quand-la-monnaie-fond/10052838>

Colmant, B. (2018, November 30). [VIDEO] Chute du bitcoin, taux d'intérêt, sommet du G20 : quel impact sur les marchés financiers ? | The Blog. Retrieved April 20, 2019, from <https://blog.degroofpetercam.com/fr/economie/1828/video-bruno-colmant-amid-faljaoui-chute-du-bitcoin-taux-dinteret-sommet-du-g20-quel-impact-sur-les-marches>

Colmant, B. (2019, January 15). Quelles orientations fiscales pour 2019-2029 ? Retrieved April 20, 2019, from <https://www.lecho.be/opinions/carte-blanche/Quelles-orientations-fiscales-pour-2019-2029/10086876>

Colmant, B. (2019, February 14). Derrière la décélération économique, la monnaie. Retrieved May 5, 2019, from <https://www.lecho.be/dossier/brunocolmant/Derriere-la-deceleration-economique-la-monnaie/10097781>

Colmant, B. (2019, February 28). Enjeux économiques d'aujourd'hui : "L'euro est une monnaie fiable" (IV) | The Blog. Retrieved May 1, 2019, from <https://blog.degroofpetercam.com/fr/economie/1901/bruno-colmant-enjeux-economiques-daujourd'hui-leuro-est-une-monnaie-fiable-iv> Contrepoints. (2015, July 22). Banque de France, banque de l'empereur. Retrieved December 15, 2018, from <https://www.contrepoints.org/2015/07/22/215030-banque-de-france-banque-de-lempereur>

Colmant, B. (2013c, May 10). Le blog de Bruno Colmant : Que signifie le "money fiat" ? Retrieved January 1, 2019, from <https://lechoblogs.typepad.com/colmant/2013/05/que-signifie-le-money-fiat-.html>

Colmant, B. (2017, 31 October). Un Belge à l'origine des monnaies alternatives ? | The Blog. Retrieved April 23rd, 2019, from <https://blog.degroofpetercam.com/fr/economie/1542/bruno-colmant-monnaies-alternatives-silvio-gesell>

CryptoCompare. (2019). Retrieved May 4, 2019, from <https://www.cryptocompare.com/>

CultureBanque. (2013, March 13). Histoire du Système LAW et la faillite bancaire française Retrieved November 13, 2018, from <https://www.culturebanque.com/banques/systeme-law-billets-faillite-banque-france/>

Currency. (2018, 5 July). Retrieved on 12 of October, 2018, from <https://www.investopedia.com/terms/c/currency.asp>

CVCE (Université du Luxembourg). (n.d.). Le "serpent" monétaire européen - L'Union économique et monétaire: origine, fonctionnement et futur. Retrieved May 2, 2019, from <https://www.cvce.eu/education/unit-content/-/unit/7124614a-42f3-4ced-add8-a5fb3428f21c/a4bac59d-7f5c-403e-83ec-5508ba53346b>

CVCE (Université du Luxembourg). (n.d.). L'Union économique - L'Union économique et monétaire: origine, fonctionnement et futur. Retrieved May 5, 2019, from <https://www.cvce.eu/education/unit-content/-/unit/7124614a-42f3-4ced-add8-a5fb3428f21c/60cf6d66-a3f1-40ea-9a5a-bb8e8cf1e137>

CVCE (Université du Luxembourg). (n.d.). Le système monétaire européen - L'Union économique et monétaire: origine, fonctionnement et futur. Retrieved May 11, 2019, from <https://www.cvce.eu/education/unit-content/-/unit/7124614a-42f3-4ced-add8-a5fb3428f21c/9eec77e2-c94d-42d3-beed-a8413e26654c>

CVCE (Université du Luxembourg). (n.d.). Les Accords de la Jamaïque - L'Union économique et monétaire: origine, fonctionnement et futur. Retrieved May 7, 2019, from <https://www.cvce.eu/education/unit-content/-/unit/7124614a-42f3-4ced-add8-a5fb3428f21c/94fb0a95-09b1-4ee1-b0ff-c24e661506f1>

Delong's Grasping Reality. (2013, May 7). A tract of Monetary Reform, Keynes 1923. Retrieved May 1, 2019, from <https://www.bradford-delong.com/2013/05/john-maynard-keynes-1923-a-tract-on-monetary-reform-pp-80-82.html>

Dessine-moi l'éco. (2012, June 12). La création monétaire, un taux d'inflation à contrôler [Video file]. Retrieved May 10, 2019, from <https://www.youtube.com/watch?v=o2u7Xa57y8A>

Diniz, E. H., Cernev, A. K., & Nascimento, E. (2016). Mobile social money: An exploratory study of the views of managers of community banks/Moeda social no celular: Estudo exploratório sobre a percepção dos gestores de bancos comunitários/Moneda social en el teléfono móvil: Estudio exploratorio sobre la percepción de los gestores de bancos

comunitarios. *Revista De Administração*, 51(3), 299-309.
doi:<http://dx.doi.org.proxy.bib.ucl.ac.be/10.1016/j.rausp.2016.02.002>

Dion, C. (Director), Laurent, M. (Director) and Levy, B. (Producer). 2015. *Tomorrow* [Film]. France : Move Movie.

Doyen, C. (2018). *Numismatique: Antiquité*. Louvain-la-neuve, Belgium: Faculté de philosophie, arts et lettres Université catholique de Louvain

Dubai to release digital payments on pundi X technology. (2018). *Entertainment Close - Up*, Retrieved from <https://search-proquest-com.proxy.bib.ucl.ac.be:2443/docview/2122167136?accountid=12156>

Economic Discussions. (n.d.). Fisher's Quantity Theory of Money: Equation, Example, Assumptions and Criticisms. Retrieved May 1, 2019, from <http://www.economicdiscussion.net/money/quantity-theory-of-money/fishers-quantity-theory-of-money-equation-example-assumptions-and-criticisms/31214>

Economic Discussions. (n.d.). Fisher's Quantity Theory of Money: Equation, Example, Assumptions and Criticisms. Retrieved May 1, 2019, from <http://www.economicdiscussion.net/money/quantity-theory-of-money/fishers-quantity-theory-of-money-equation-example-assumptions-and-criticisms/31214>

EduBourse. (2014, March 17). *Faillite du Système de Law en 1720*. Retrieved November 1, 2018, from <https://www.edubourse.com/guide-bourse/faillite-law.php>

Einaudi, L. (2018, March 1). *A Historical Perspective on the Euro: the Latin Monetary Union (1865–1926)*. ifo DICE. Retrieved from <https://www.ifo.de/DocDL/dice-report-2018-3-einaudi-oct.pdf>

Encyclopaedia Universalis. (n.d.). *L'impôt du sel (gabelle)*. Retrieved November 13, 2018, from <https://www.universalis.fr/encyclopedie/sel/3-l-impot-du-sel-gabelle/>

ETCHELEKU, P. (2017, Jan 30). *La monnaie locale basque eusko se dématérialise*. *Les Echos*. Retrieved from <https://search-proquest-com.proxy.bib.ucl.ac.be:2443/docview/1862879736?accountid=12156>

Euro. (n.d.). *Euro*. Retrieved May 12, 2019, from <https://www.investopedia.com/terms/e/euro.asp>

FEDERAL RESERVE BANK OF DALLAS. (2004). *David Ricardo Theory of Free International Trade*. *Economic Insights*, 9(2).

FEDERAL RESERVE BANK OF DALLAS. (2005). *Irving Fisher: Origins of Modern Central Bank Policy*. *Economic Insights*, 10(1).

Fendel, R., & Maurer, D. (2015). Does European History Repeat Itself ? : Lessons from the Latin Monetary Union for the European Monetary Union. *Journal of Economic Integration*, 30(1), 93–120. <https://doi.org/10.11130/jei.2015.30.1.93>

Finance de marché. (n.d.). Serpent Monétaire Européen Définition. Retrieved May 3, 2019, from <http://financedemarche.fr/definition/serpent-monetaire-europeen>

Flandreau, M., P. E. M., Leeming, O., & Oxford University Press. (2004). *The Glitter of Gold: France Bimetallism and the Emergence of the International Gold Standard 1848-1873*. London: OUP Oxford.

France culture. (2017, September 4). L'intérêt de la monnaie (1/4) : Dans la peau de John Maynard Keynes. Retrieved May 1, 2019, from <https://www.franceculture.fr/emissions/entendez-vous-leco/linteret-de-la-monnaie-14-dans-la-peau-de-john-maynard-keynes>

France Culture. (2019, May 1). La valeur de la monnaie (3/4) : Guerre des devises : la menace fantôme. Retrieved May 15, 2019, from <https://www.franceculture.fr/emissions/entendez-vous-leco/entendez-vous-leco-emission-du-mercredi-01-mai-2019>

FTV Education. (2013, August 23). Adam Smith contre les physiocrates et les mercantilistes. Retrieved April 30, 2019, from <https://education.francetv.fr/matiere/economie/premiere/article/adam-smith-contre-les-physiocrates-et-les-mercantilistes>

Girasa, R. (2018). Regulation of Cryptocurrencies and Blockchain Technologies. <https://doi.org/10.1007/978-3-319-78509-7>

Godelier, M. (2009). *La production des grands hommes: pouvoir et domination masculine chez les Baruya de Nouvelle-Guinée*. Paris, France: Flammarion.

Goetzmann, W. N. (2005). *The Origins of Value: The Financial Innovations that Created Modern Capital Markets*. New York, USA: Oxford University Press.

Gouvernement de la republique française. (n.d.). Création du "franc germinal". Retrieved November 13, 2018, from <https://www.gouvernement.fr/partage/10952-creation-du-franc-germinal>

Guillaume, E. (2019, April 14). [Analyse] La Corée du Sud est-elle le catalyseur de la prochaine hausse des cryptomonnaies.... Retrieved May 12, 2019, from <https://cryptoactu.com/analyse-la-coree-du-sud-est-elle-le-catalyseur-de-la-prochaine-hausse-des-cryptomonnaies/>

Halaburda, H., & Sarvary, M. (2016). *Beyond Bitcoin* (Rev. ed.). <https://doi.org/10.1057/9781137506429>

Hayek, F. A. (1976). Choice in Currency: A WAY TO STOP INFLATION. Retrieved May 12, 2019, from <https://www.iea.org.uk/sites/default/files/publications/files/upldbook409.pdf>

Here's what Maduro has said of Venezuela's Petro Cryptocurrency. (2018). Wealth Management, Retrieved from <https://search-proquest-com.proxy.bib.ucl.ac.be:2443/docview/2090217476?accountid=12156>

Herodote. (n.d.). 18 janvier 1800 - Naissance de la Banque de France - Herodote.net. Retrieved December 13, 2018, from https://www.herodote.net/18_janvier_1800-evenement-18000118.php

Herodote.net. (2018, November 27). 23 décembre 1865 - Naissance de l'Union latine - Herodote.net. Retrieved December 13, 2018, from https://www.herodote.net/23_decembre_1865-evenement-18651223.php

Herodote.net. (n.d.). 26 octobre 1795 - La Convention cède la place au Directoire - Herodote.net. Retrieved December 4, 2018, from https://www.herodote.net/26_octobre_1795-evenement-17951026.php

Hewitt, V. H., & British Museum. (1995). The Banker's Art: Studies in Paper Money. London, England: British Museum Press.

Homans, G. (n.d.). Crypto-monnaies (Bitcoin, Ether, etc.) : quelle fiscalité belge ? | Wolters Kluwer. Retrieved April 20, 2019, from <https://taxworld.wolterskluwer.be/fr/nouvelles/l-edito/crypto-monnaies-bitcoin-ether-etc-quelle-fiscalite-belge/>

How a 1944 Agreement Created a New World Order. (2019, January 2). Retrieved January 30, 2019, from <https://www.thebalance.com/bretton-woods-system-and-1944-agreement-3306133>

Hume, D. (1752, January 1). Of the balance of Trade. Retrieved April 30, 2019, from <http://la.utexas.edu/users/hcleaver/368/368HumeTradetable.pdf>

International Monetary Fund, Benes, J., & Kumhof, M. (2012). The Chicago Plan Revisited. Retrieved from <https://www.imf.org/external/pubs/ft/wp/2012/wp12202.pdf>

Investopedia (2018). David Ricardo. Retrieved May 1, 2019, from <https://www.investopedia.com/terms/d/david-ricardo.asp>

Investopedia (2018). Maastricht Treaty. Retrieved May 6, 2018, from <https://www.investopedia.com/terms/m/maastricht-treaty.asp>

Investopedia (2018). Friedrich Hayek. Retrieved May 3, 2019, from <https://www.investopedia.com/terms/f/friedrich-hayek.asp>

Investopedia (2019). Bretton Woods Agreement. Retrieved January 17, 2018, from <https://www.investopedia.com/terms/b/brettonwoodsagreement.asp>

Investopedia (2019). European Monetary System (EMS). Retrieved May 10, 2019, from <https://www.investopedia.com/terms/e/ems.asp>

Investopedia. (2018). Ricardian Equivalence. Retrieved May 1, 2019, from <https://www.investopedia.com/terms/r/ricardianequivalence.asp>

Investopedia. (2018, June 6). Legal Tender. Retrieved May 20, 2019, from <https://www.investopedia.com/terms/l/legal-tender.asp>

Investopedia. (2018). Euro. Retrieved May 12, 2019, from <https://www.investopedia.com/terms/e/euro.asp>

Investopedia. (2019). The 2007-08 Financial Crisis in Review. Retrieved May 7, 2019, from <https://www.investopedia.com/articles/economics/09/financial-crisis-review.asp>

Investopedia. (2019). Keynesian Economics Definition. Retrieved May 2, 2019, from <https://www.investopedia.com/terms/k/keynesianeconomics.asp>

Investopedia. (2019). Complementary Currency. Retrieved May 25, 2019, from <https://www.investopedia.com/terms/c/complementary-currency-cc.asp>

Investopedia. (2019). Cryptocurrency. Retrieved April 20, 2019, from <https://www.investopedia.com/terms/c/cryptocurrency.asp>

Investopedia. (2019). Blockchain, Explained. Retrieved May 23, 2019, from <https://www.investopedia.com/terms/b/blockchain.asp>

Investopedia. (2019). European Currency Unit (ECU). Retrieved May 13, 2019, from <https://www.investopedia.com/terms/e/european-currency-unit.asp>

Investopedia. (2019). Mercantilism. Retrieved May 10, 2019, from <https://www.investopedia.com/terms/m/mercantilism.asp>

Investopedia. (2019). Classical Economics and the Evolutions of Capitalism. Retrieved May 1, 2019, from <https://www.investopedia.com/terms/c/classicaleconomics.asp>

Kennedy, M., Lietaer, B., & Rogers, J. (2012). People Money: The promise of regional currencies. Devon: Triarchy Press.

Keytrade Bank. (2019, March 27). Adieu l'argent liquide ? Retrieved May 15, 2019, from https://www.keytradebank.be/fr/aide/articles/822-adieu-largent-liquide-/?utm_source=selligent

Koning, J. P. (2013, January 4). Yap stones and the myth of fiat money. Retrieved November 13, 2018, from <http://jpkoning.blogspot.com/2013/01/yap-stones-and-myth-of-fiat-money.html>

L'intégration monétaire et financière européenne - ppt télécharger. (n.d.). Retrieved May 3, 2019, de <https://slideplayer.fr/slide/3140630/>

La Libre. (2010, July 14). La ruine du système de Law. Retrieved November 11, 2018, from <https://www.lalibre.be/economie/libre-entreprise/la-ruine-du-systeme-de-law-51b8c03de4b0de6db9bc6f80>

Lainey, J. C. (2004). La "monnaie des sauvages": les colliers de wampum d'hier à aujourd'hui (3rd ed.). Sillery, Québec, Canada: Septentrion.

Laystary, É. (2018). Découvertes - L'estonie lance l'estcoin, son propre token national (French ed. ed.). Paris: SyndiGate Media Inc. Retrieved from <https://search-proquest-com.proxy.bib.ucl.ac.be:2443/docview/2102899792?accountid=12156>

Le "Turkcoin" : la Turquie envisage de créer sa monnaie numérique nationale - Crypto-France. (2018, February 23). Retrieved May 7, 2019, from <https://www.crypto-france.com/turkcoin-turquie-monnaie-numerique-nationale/>

Le journal d' Hugot. (2017, July 5). L'histoire de la monnaie : du troc à l'euro. Retrieved November 12, 2018, from <https://www.hugolescargot.com/le-journal-d-hugo/actualites/36521-l-histoire-de-la-monnaie-du-troc-a-l-euro/>

Le projet européen CCIA plaide en faveur de la création de monnaies complémentaires en l'euro. (2015, Jun 15). PR Newswire Europe (French). Retrieved from <https://search-proquest-com.proxy.bib.ucl.ac.be:2443/docview/1688731551?accountid=12156>

Lee C. Gilliland, C. (1975). The Stone Money of Yap of A NUMISMATIC SURVEY. City of Washington, USA: SMITHSONIAN INSTITUTION PRESS.

Les Echos. (2011, December 18). 18 décembre 1971 : la fin de Bretton Woods. Retrieved March 20, 2018, from <http://blogs.lesechos.fr/echos-d-hier/18-decembre-1971-la-fin-de-bretton-a7951.html?h0S4cTpbb59A2jQa.99>

Library and Archives Canada Blog. (2015, April 28). Wampum belts. Retrieved November 3, 2018, from <https://thediscoverblog.com/2015/04/28/wampum-belts/>

Lietaer, B. (2013, August 12). Pourquoi les monnaies complémentaires sont-elles nécessaires à la stabilité économique ? La preuve scientifique.. Retrieved May 10, 2019, from <http://www.lietaer.com/2013/08/pourquoi-les-monnaies-complementaires-sont-elles-necessaires-a-la-stabilite-economique-la-preuve-scientifique/>

L'inflation en France : l'épisode de John Law et les assignats. (2011, June 27). Retrieved December 14, 2018, from <http://www.sacra-moneta.com/Sites-divers/L-inflation-en-France-l-episode-de-John-Law-et-les-assignats.html>

L'or et l'Argent. (2009, October 13). L'accord de la Jamaïque : démonétisation de l'or.. Retrieved April 29, 2019, from <https://www.loretlargent.info/non-classe/laccord-de-la-jamaïque-demonetisation-de-lor/2537/>

Loraux, N. (1983). Maurice Godelier, La production des Grands hommes. Pouvoir et domination masculine chez les Baruya de Nouvelle-Guinée, Paris, Fayard, « L'espace du politique », 1982, 370 p. *Annales. Histoire, Sciences Sociales*, 38(6), 1264–1268. <https://doi.org/10.1017/s0395264900083268>

Lyons, M. (1994). Napoleon Bonaparte and the Legacy of the French Revolution. New York, USA: Macmillan Education UK.

Mankiw, N. G., & Taylor, M. P. (2014). *Economics* (3rd ed.). Louvain-la-neuve, Belgique: De Boeck.

Mason, B. (n.d.). How Does Cryptocurrency Mining Work? And What is Cryptocurrencies Hashrate? Retrieved April 20, 2019, from <https://www.fxempire.com/education/article/how-does-cryptocurrency-mining-work-and-what-is-cryptocurrencies-hashrate-423934>

Mobilepaymentstoday.com: Mizuho bank to launch J-coin pay digital currency platform (2019). Chatham: Newstex. Retrieved from <https://search-proquest-com.proxy.bib.ucl.ac.be:2443/docview/2184625954?accountid=12156>

Moreau, J. (1969). Aristote et la monnaie. *Revue des Études Grecques*, 82(391), 349–364. <https://doi.org/10.3406/reg.1969.1087>

Mourselas, C., McLellan, L., & West, O. (2018). Venezuela's petro cryptocurrency meets cold reception. *Global Capital*, Retrieved from <https://search-proquest-com.proxy.bib.ucl.ac.be:2443/docview/2017884687?accountid=12156>

National Bank of Belgium. (n.d.). Cowry Shells, a trade currency — Museum of the National Bank of Belgium. Retrieved October 28, 2018, from <https://www.nbbmuseum.be/en/2007/01/cowry-shells.htm>

National Museum of Australia. (n.d.). Gold rushes | National Museum of Australia. Retrieved December 24, 2018, from <https://www.nma.gov.au/defining-moments/resources/gold-rushes>

Noizat, P. (2013, December 16). Une mine de bitcoin, c'est quoi ? Retrieved March 10, 2019, from <https://www.atlantico.fr/decryptage/927546/une-mine-de-bitcoin-c-est-quoi--pierre-noizat>

NumisCorner. (2017, September 8).

Paradis, L. (1979). Le cacao précolombien : monnaie d'échange et breuvage des dieux. *Journal d'agriculture traditionnelle et de botanique appliquée*, 26(3), 181–199. <https://doi.org/10.3406/jatba.1979.3800>

Poireault, K. (2018, November 5). Crypto-monnaie: le petro va-t-il relancer l'économie vénézuélienne? Retrieved April 5, 2019, from <http://www.rfi.fr/economie/20181105-venezuela-petro-crypto-monnaie-maduro-bitcoin-centralise>

RES. (n.d.). RES - À propos de nous. Retrieved April 15, 2019, from <https://www.res.be/fra/marchands/a-propos-de-nous>

Ricardo, D. (2001). On the principles of political economy and taxation. Kitchener, Ontario, USA: Batoche Books.

Riksbank. (2018, October). The Riksbank's e-krona project Report 2. Retrieved May 5, 2019, from <https://www.riksbank.se/globalassets/media/rapporter/e-krona/2018/the-riksbanks-e-krona-project-report-2.pdf>

Riksbank. (2019). E-krona. Retrieved May 5, 2019, from <https://www.riksbank.se/en-gb/payments--cash/e-krona/>

Roncaglia, A. (2006). The Wealth of Ideas: A History of Economic Thought (Ed. rev.). New York, United States of America: Cambridge University Press.

RTBF. (2019, March 15). Secteur bancaire: la chute du nombre d'emplois est vertigineuse depuis 2000. Retrieved May 15, 2019, from https://www.rtbf.be/info/economie/detail_secteur-bancaire-la-chute-du-nombre-d-emplois-est-vertigineuse-depuis-2000?id=10171713

SAR Publisher. (2019, January 20). Stone Money of Micronesia–Rai stones – SAR Publisher. Retrieved February 2, 2019, from <https://www.sarpublisher.com/stone-money-of-micronesia-rai-stones/>

Souchon, R. (2018, March 7). Les limites de la création monétaire [Video file]. Retrieved May 7, 2019, from <https://www.youtube.com/watch?v=OD6OTU6fdMg>

Soulié, M. (n.d.). ALLEMAGNE 1923 : QUAND IL FALLAIT UNE BROUETTE DE BILLETS POUR AFFRANCHIR UNE LETTRE ! QUELQUES LETTRES EXCEPTIONNELLES. Retrieved December 24, 2018, from [https://www.asso-philatelique-montpellier.fr/uploaded/Fichiers/note-exemples-allemagne-1923-copy\(1\).pdf](https://www.asso-philatelique-montpellier.fr/uploaded/Fichiers/note-exemples-allemagne-1923-copy(1).pdf)

Stealth's blockchain uses new economic system to fairly reward quantum proof-of stake activity: Stealth's new economic mechanism for selecting transaction validators set to revolutionize proof of stake block scheduling. (2019, May 02). NASDAQ OMX's News Release Distribution Channel Retrieved from <https://search-proquest-com.proxy.bib.ucl.ac.be:2443/docview/2218360256?accountid=12156>

Steemitblog. (2017). BITCOIN ATM. Retrieved May 10, 2019, from <https://steemit.com/cryptocurrency/@prabhatchugh/shoutout-to-people-in-birmingham-bitcoin-atm>

Stroud, F. (n.d.). What Is Cryptocurrency Mining? Webopedia Definition. Retrieved May 25, 2019, from <https://www.webopedia.com/TERM/C/cryptocurrency-mining.html>

Swammy, S., Thompson, R., & Loh, M. (2018). Crypto Uncovered. <https://doi.org/10.1007/978-3-030-00135-3>

The E-Sylum. (2013, September 8). MORE ON JOHN MAYNARD KEYNES AND YAP STONE MONEY. Retrieved November 3, 2018, from http://www.coinbooks.org/esylum_v16n37a18.html

The french revolution, the assignats, and the counterfeiters. Retrieved November 14, 2018, from <https://www.numiscorner.com/blogs/news/the-french-revolution-the-assignats-and-the-counterfeiters>

The library of Economics and Liberty. (n.d.). David Hume. Retrieved April 30, 2019, from <https://www.econlib.org/library/Enc/bios/Hume.html>

The National Archives. (2018, July 17). Keynes on the Gold Standard - The National Archives. Retrieved May 1, 2019, from <http://www.nationalarchives.gov.uk/education/resources/twenties-britain-part-one/keynes-on-the-gold-standard/>

The nightmare German inflation. (n.d.). Retrieved January 24, 2018, from <https://www.usagold.com/cpmforum/the-nightmare-german-inflation/>

The vintage news. (2018, January 21). Cowry shell coins: an ancient monetary system based on sea shells used on almost every continent. Retrieved September 4, 2018, from <https://www.thevintagenews.com/2018/01/21/cowry-shell-coins/>

Tindermans, L. (1976). L'Union européenne. Rapport de Léo Tindemans au Conseil européen. Retrieved from <http://aei.pitt.edu/942/>

Unichange. (n.d.). The history and origins of money. Retrieved November 12, 2018, from https://unichange.me/articles/cowry_shell_e-currency

Université de Poitiers. (n.d.). Le franc Germinal. Retrieved November 3, 2018, from <http://sceco.univ-poitiers.fr/hfranc/Germinal.htm>

Université de Renne. (n.d.). 14.1.1. Le régime de l'étalon-or (1879-1933). Retrieved December 24, 2018, from <https://perso.univ-rennes1.fr/denis.delgay-troise/RMI/Cours/RMI411.pdf>

University., Rouwenhorst, Goetzmann & Finance (2005). The Origins of Value: The Financial Innovations that Created Modern Capital Markets. New York, USA: Oxford University Press.

Villey, D., & Neme, C. (1985). Petite histoire des grandes doctrines économiques. Paris, France: Edition Génin

Walrafen, T., & Association d'économie financière. (1994). Bretton Woods: mélanges pour un cinquantenaire. Unknown: Association d'économie financière.

Watson, T. (2018). The real value of bitcoin. Ivey Business Journal (Online), 1-8. Retrieved from <https://search-proquestcom.proxy.bib.ucl.ac.be:2443/docview/2224301544?accountid=12156>

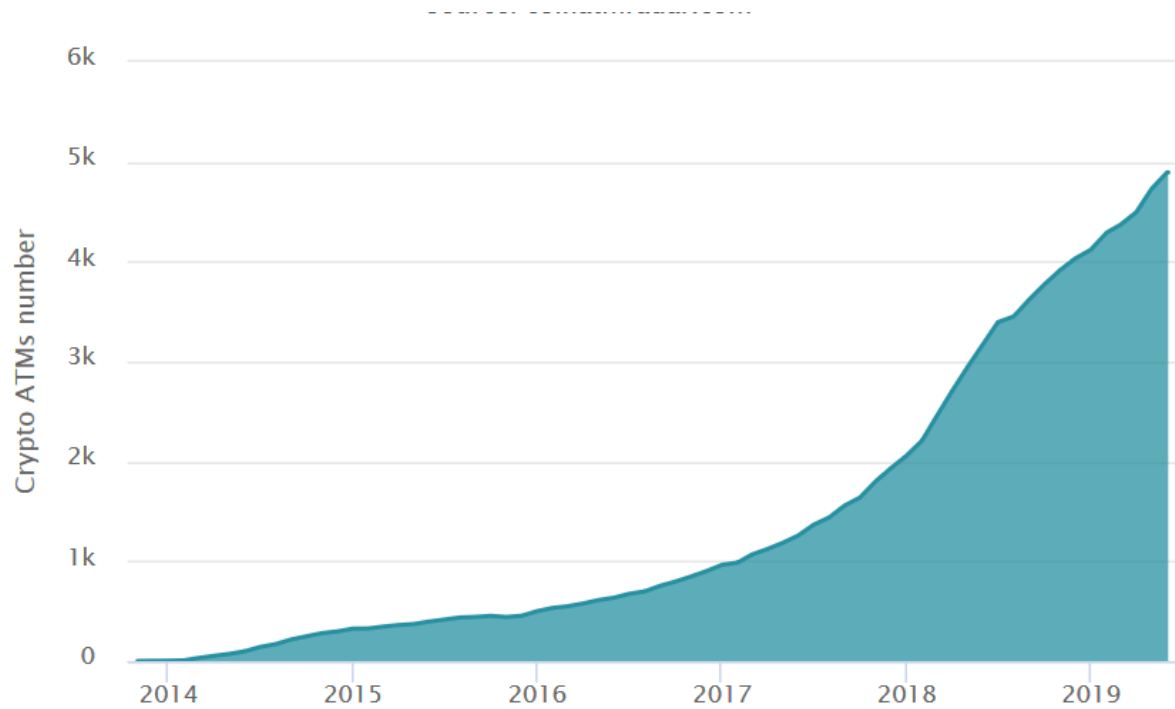
Who were the physiocrats? (2013, October 11). Retrieved April 29, 2019, from <https://www.economist.com/free-exchange/2013/10/11/who-were-the-physiocrats>

Williams, J. (2000). On an example of Chinese paper currency of the Ming dynasty. London, England: The Numismatic Society of London.

YANG, B. (2011). The Rise and Fall of Cowrie Shells: The Asian Story. *Journal of World History*, 22(1).

Appendix

Appendix 1: Crypto ATM Installations Growth



Source: coinatmradar.com

Appendix 2: Bitcoin ATMs by Country

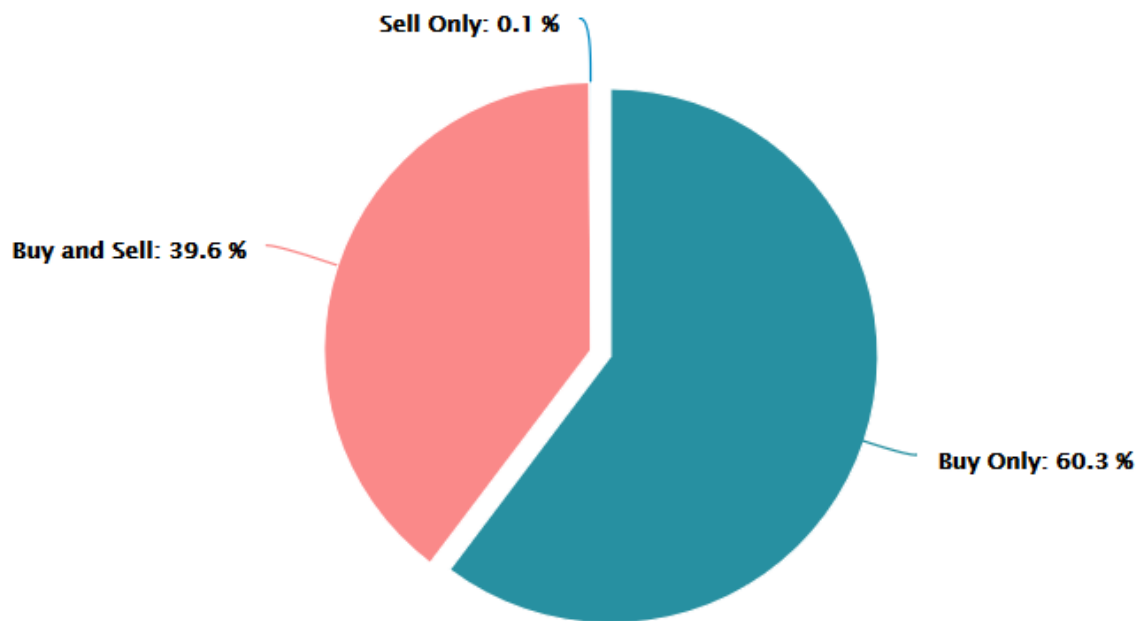
Bitcoin ATMs are installed in many countries in the world. The current distribution of installations accross the countries can be found on The Chart of Bitcoin ATM number by Continents and Countries.

Albania (1 location)
Andorra (1 location)
Anguilla (1 location)
Argentina (10 locations)
Armenia (1 location)
Aruba (1 location)
Australia (19 locations)
Austria (272 locations)
Bahamas (1 location)
Bahrain (1 location)
Barbados (1 location)
Belgium (12 locations)
Bosnia and Herzegovina (1 location)
Botswana (1 location)
Brazil (2 locations)
Bulgaria (3 locations)
Canada (702 locations)
Chile (3 locations)
Colombia (40 locations)
Costa Rica (2 locations)
Croatia (6 locations)
Czech Republic (66 locations)
Denmark (2 locations)
Djibouti (1 location)
Dominican Republic (12 locations)
Ecuador (3 locations)
Estonia (6 locations)
Finland (20 locations)
France (1 location)
Georgia (13 locations)
Germany (29 locations)
Greece (29 locations)
Guam (2 locations)
Guatemala (1 location)
Hong Kong (39 locations)
Hungary (23 locations)
India (1 location)
Indonesia (1 location)
Ireland (4 locations)
Israel (6 locations)
Italy (42 locations)

Japan (5 locations)
Kazakhstan (3 locations)
Kenya (1 location)
Kosovo (3 locations)
Latvia (1 location)
Liechtenstein (2 locations)
Malaysia (10 locations)
Malta (4 locations)
Mexico (12 locations)
Mongolia (1 location)
Netherlands (26 locations)
New Zealand (2 locations)
Norway (2 locations)
Panama (10 locations)
Peru (2 locations)
Philippines (1 location)
Poland (40 locations)
Portugal (3 locations)
Romania (34 locations)
Russian Federation (60 locations)
Saint Kitts and Nevis (1 location)
San Marino (1 location)
Saudi Arabia (2 locations)
Serbia (6 locations)
Singapore (8 locations)
Slovakia (42 locations)
Slovenia (14 locations)
South Africa (6 locations)
South Korea (1 location)
Spain (88 locations)
Switzerland (55 locations)
Taiwan (9 locations)
Thailand (3 locations)
Turkey (3 locations)
Uganda (1 location)
Ukraine (12 locations)
United Kingdom (243 locations)
United States (3102 locations)
VietNam (8 locations)
Zimbabwe (1 location)

Source: coinatmradar.com

Appendix 3: Crypto ATM support for buy and sell transactions



Source: coinatmradar.com

