

Louvain School of Management

Impact of the NIRP on the European Banks' Profitability: Empirical Analysis of Three Business Models

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Nicolas De Crom

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Supervisor(s)
Denis Knaepen

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List of Abbreviations

AT 1	Additional Tier 1 Capital
BCBS	Basel Committee on Banking Supervision
BIS	Bank for International Settlements
bp	basis point
CET 1	Common Equity Tier 1
ECB	European Central Bank
EONIA	Euro Overnight Index Average
F&C	Fee & Commission
G-SIFI	Global Systemically Important Financial Institution
HQLA	High Quality Liquid Asset
LCR	Liquidity Coverage Ratio
LTRO	Long-Term Refinancing Operation
MRO	Main Refinancing Operation
NII	Net Interest Income
NIM	Net Interest Margin
NIRP	Negative Interest Rate Policy
NSFR	Net Stable Funding Ratio
REFI	Refinancing rate
ROA	Return on Assets
ROE	Return on Equity
RWA	Risk Weighted Assets
TLTRO	Targeted Longer-Term Refinancing Operation

Introduction

Following the great financial crisis of 2007-2008, the global economy is in a poor shape. Central banks around the globe are striving to revive their respective economy by designing accommodative policies. The main goal of accommodative policies is to increase the aggregate inflation expectation and avoid by any means a deflationary spiral which could have a devastating impact.

Among the unconventional monetary policies, the European Central Bank introduced the negative interest rate policy (NIRP) in 2014. This policy is intended to compel European financial institutions to increase their loan volume towards the non-financial private sector and ease the credit conditions to boost the aggregate demand for credit. The twofold effect would in turn stimulates inflation and hopefully gets on tracks the European economy. Nevertheless, the NIRP spurs a lot of concerns and criticism from financial institutions. The main reason behind this uprising is the potential negative impact the negative interest rates would induce on the banks' generation of income and, a fortiori, on their profitability.

Banks are considered as a pillar of the economy and contribute greatly to its growth (Canadian Bankers Association, 2016). Indeed, at one end of the spectrum large banks help corporations to manage their money. At the other end, small banks grant loans and mortgages to households and small businesses and provide a safe place to store their savings. Hence, as banks profit are tanking, the economy could suffer with another financial crisis due to the worsening financial shape of banks or the excessive risk taking from financial institutions in order to compensate for the compressed margins. Previous works have studied the NIRP impacts on the banking industry as a whole without differentiating banks according to their focused business model. In addition, researchers have explored the differences between financial institutions following different business models but, failed to pursue their studies after the introduction of the negative interest rates.

Therefore, the particularity of this master thesis is to assess the potential impact of the negative interest rates on the profitability of different bank business models. We put forward the hypothesis that the financial institutions which are more retail oriented would be more affected than banks that heavily participate in trading activities and asset management. This effect would translate in a significantly lower return on equity of the retail oriented banks. Then, we will examine two other key components of the bank profitability. First, we assess the evolution of the sources of income of the financial institutions. Indeed, we have the intuition

that in order to cope with the negative interest rates, financial institutions could switch their sources of income from the net interest income towards the non-interest income. Secondly, we establish if the negative interest rates have reached their expected goal of enhancing the loan growth to non-financial corporations and households. The reason is twofold. On the one hand, a significant change in the loan volume would give an insight in order to explain the performance of financial institutions and the results of the second hypothesis. On the other hand, we could assess the efficiency of the transmission mechanism of the monetary policies designed by the European Central Bank with an emphasis on the negative interest rate policy. Finally, with the goal of having the full picture, we will look at the equity of the financial institutions which was influenced by the Basel III Accords.

In order to confront these three hypotheses, we have divided this master thesis in two parts. The first part is composed of three chapters. The first chapter outlines the liquidity trap and its cause: the zero lower bound. Then we introduce the history and the origins of the negative interest rates which were discussed as a means to overcome the zero lower bound. In the second chapter, we present the situation in which the European Central Bank has decided to introduce the negative interest rates on its deposit facility. Furthermore, we show the impact of the negative interest rates through the channels they are transmitted. Then, the third chapter summarises the sources of income of banks and the recent regulations imposed by the Basel Committee on Banking Supervision. Moreover, it talks about the profitability of banks for the past decades and discusses the past research done on the impact of the negative interest rate policy on banks' profitability.

The second part, which is related to the methodology and the empirical results, also contains three chapters. Chapter four introduces the data and the methodology used in order to classify banks and analyse their profitability. Indeed, we have gathered the consolidated annual financial statements of Eurozone banks and banks whose headquarters are located in the European Economic Area such as Denmark and Sweden, with the aim of assigning them to a defined business model. Furthermore, we use statistical tools to assess if the introduction of the negative interest rates has significantly impacted the profitability of the different business models or their income generation. In chapter five, we analyse the results of our clustering algorithm as well as the T-test results in order to confront our hypotheses put forward. Following that, in chapter six, we will discuss the results and present the limitations that we faced during the realisation of this master thesis. Finally, a short conclusion will highlight the key findings of our research and discussions.

Chapter 1 History of the Negative Interest Rates

1.1 The Nominal and the Real Interest Rates

1.1.1 Nominal Interest Rate

Before getting in more details about the negative interest rates, it is important to make the distinction between the nominal interest rate and the real interest rate. Throughout this master thesis we are going to mainly talk about the nominal interest rate because it is the prime instrument central banks are manipulating in order to control where the economy is heading in the future (ECB, 2012). By affecting the short-nominal interest rates, through the interest rate they set on the refinancing rate, the European Central Bank can meet its objective of maintaining price stability over the medium term. Hence, it can support a sustainable growth and low level of unemployment for the European Monetary Union (ECB, 2017a).

The nominal rate is the actual rate used to price securities and set interest rates for loans. It is the rate that is agreed upon by the two sides of a trade (ECB, 2016a). It is affected by the inflationary expectations. If it is expected that the economy will be experiencing higher levels of prices, the level of nominal interest rates will rise in accordance (Lubochinsky, 1987). However, the nominal interest rates do not capture the real evolution of the purchase power. Therefore, there must be another interest rate that captures the fluctuations of prices.

1.1.2 Real Interest Rate

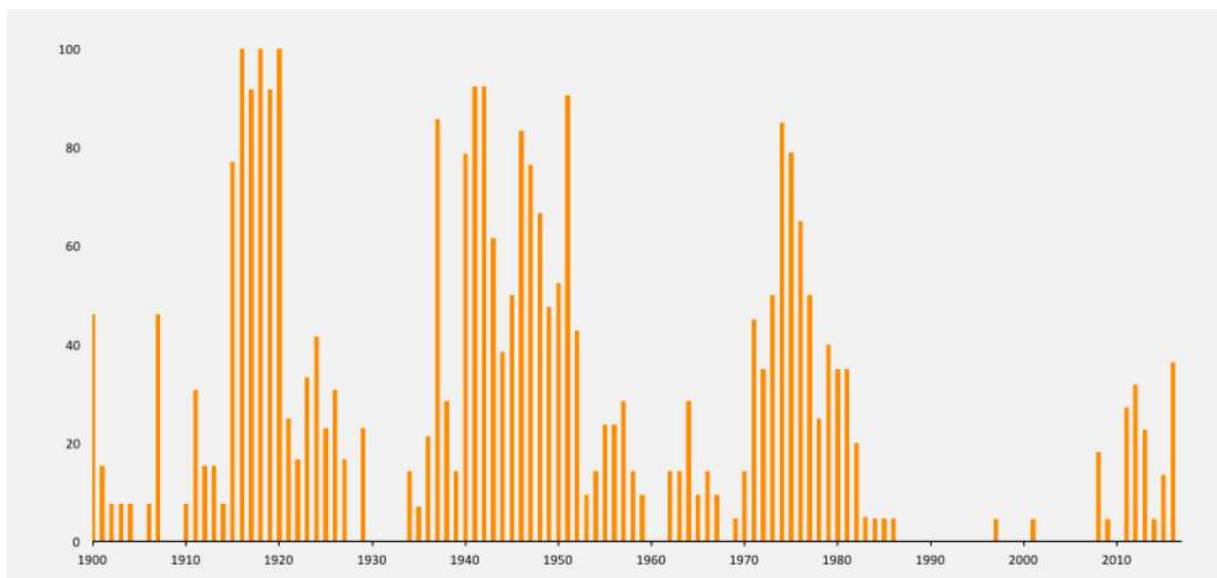
The real interest rate is, following the Fischer equation, the nominal rate to which we have subtracted the expected inflation (Lubochinsky, 1987). It is the rate that investors should look at to avoid an erosion of their purchasing power (Larson et al., 2003). In situations where the real rate is negative, investors are accepting to buy a bond that will have less purchasing power at maturity. For instance, if I buy a bond worth \$100 with a yearly nominal interest rate of 2% and a maturity of one year while the inflation level is at 4%. After one year, I will receive the interest and principal payments, which the sum is equal to \$102. However, I would need to have \$104 to buy the same amount of goods or services at the present moment that were valued at \$100 a year earlier. In this situation, consumers have a strong incentive to purchase goods and services now.

We have experienced several times the real rate going negative because of the actual inflation being higher than the expected inflation, which is translated by a lower nominal

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interest rate than the inflation rate. It had been demonstrated through several studies during the past decades and summarised on Figure 1 (Reinhart, 2016). The figure computes the annual sum of 10-year treasury obligations with a negative real interest rate year on year among the advanced economies during the 1900 to 2016 period. It can be seen on the graph that the advanced countries' economies have suffered from negative real returns on multiple occasions. Moreover, during the Great Depression, it was the contrary. The actual inflation was low, which resulted in a positive real interest rate. Typically, the real interest rates become negative in recession eras because of the monetary policy of central banks designed to lower the nominal interest rates with the aim of driving the recovery of their economy (Bernanke, 2016).

Figure 1: *Annual sum of 10-year treasury bonds of advanced economies with negative real interest rate (1900-2016)*



Source: World Economic Forum © Reinhart & Sbrancia (2015)

However, we are not familiar with the concept of nominal rates doing the same. Indeed, it is totally in distortion with the reality we have of the financial world (Randow & Kennedy, 2013). We must imagine a situation where the savers are penalised for hoarding cash while the spenders are rewarded for their behaviour. In other words, as a reference to the famous French poet Jean de la Fontaine, the cicada which is partying all year would be the happy one at the end of the fable.

1.2 The Liquidity Trap

When the rates of interest are at or near the zero border, we face the risk of falling into a liquidity trap. A liquidity trap can be defined as: “*a situation in which conventional monetary policies have become impotent because nominal interest rates are or at near zero: injecting monetary base into the economy has no effect, because base and bonds are viewed by the private sector as perfect substitutes.*” (Krugman, 1998, p. 141) Keynes mentioned that there were three forms of liquidity trap: the weak version, the strong version and the extreme version (Keynes, 1936). The three cases are nearly similar, in the fact that they differ from a small degree. Indeed, it refers to the different liquidity preferences in response to a change to interest rates. The weak form states that the preference towards liquidity rises to high levels but won't be infinite when the level of interest rates is low. A fortiori, the extreme case occurs when the preference towards liquidity is infinite as the rates fall towards the lower border (Keynes, 1936). However, following the analysis of Beranek and Timberlake (1987), the weak form is not relevant because it is not a trap according to the strict notion of the term. Indeed, monetary policies can decrease the rates of interest equilibrium and, consequently, stimulate the economy. Extensive literature has been produced on the liquidity trap and its causes such as Gärtner & Jung (2010), Svensson (2003), and Keynes (1936).

We can visualise the liquidity trap using the IS/LM model or the Hicks-Hansel Model. Specifically, if we are looking at the liquidity preference (L) and money supply (M) curve/relation. Given the invariability of the money supply and that the curve represents all the different combinations which give the market equilibrium on the money market, we can deduce these three equations (Mignon, 2009):

$$\left\{ \begin{array}{l} L = M \\ L = L_1 + L_2 \Leftrightarrow \alpha Y - \beta i \\ M = M_0 \end{array} \right.$$

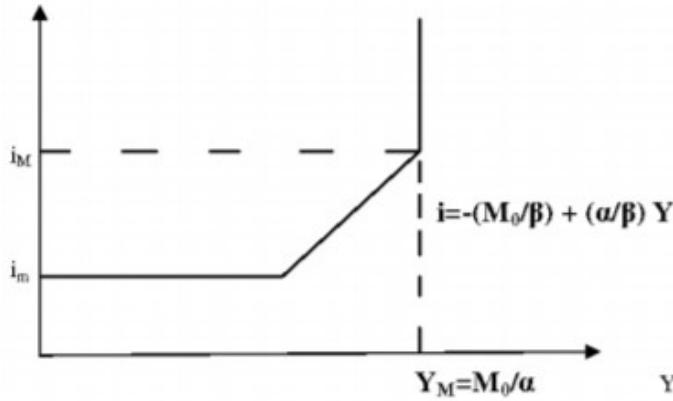
L_1 and L_2 are respectively the demand for money by the market players for wages and the demand for money for speculative reasons. Y is representing the real GDP and i is the level of interest rates (Mignon, 2009). From these three equations, we can calculate the relation:

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$$i = \left(-\frac{M_0}{\beta}\right) + \left(\frac{\alpha}{\beta} * Y\right)$$

We can illustrate this relation graphically (see Fig. 2).

Figure 2: *Liquidity preference and money supply relation*



Source: Mignon V. (2009)

As we can see on the graph, at a certain i_m level of interest rates, the market players prefer to transform all their assets in the most liquid form, namely the paper currency, and hoard it.

It can be easily deduced that the main cause of the liquidity trap is the zero lower bound. The zero lower bound is existing due to the nature of the paper money (Buiter, 2010). Financial instruments such as paper currency, bonds, stocks, etc. can be separate into two categories: the registered instruments and the bearer instruments.

1.2.1 Registered Instruments

On the one hand, the registered instruments are instruments with which we can trace back the ownership of the instrument. There is a book-entry system which allows us to record the identity of the owner and which must be maintained by the issuer of the instrument. Therefore, the issuer knows at any time the identity of the holder of the instrument. When a transfer is made, the issuer has the obligation to modify the book-entry system to reflect the current ownership of the instrument (Land, 2005). The Bitcoin perfectly illustrates the registered instruments. When a Bitcoin owner sells his ownership right to another investor, the transaction is registered on several servers so that we can trace back the ownership till the market maker (World Economic Forum, 2016).

1.2.2 Bearer Instruments

On the contrary, the bearer instruments are held by owners who are unknown to the issuer. There are no records taken and kept of the ownership or the transfer of the ownership. Therefore, the issuer (borrower) of the note does not have information on the owner of the instrument (creditor, holder or bearer). For instance, when a person A issues a bond to a person B, he retains no information on the identity of the owner or the holder of the bond, namely person B. Hence, it is highly difficult for the person B to gain a positive interest rate because he has to present himself to the issuer and prove that he is the legal holder of the bond. Furthermore, the holder could show the same instrument several times to the issuer with the aim of receiving the interest payment multiple times (Buiter, 2010).

However, in the past, bonds would have coupons attached to them in order to redeem the interest rate payment. This method avoided that bond holders would deliberately try to beat the system. While the payment of positive interest rate is possible, yet logistically difficult, the payment of negative interest rate is highly doubtful. Indeed, the bond holder has no incentive to reveal himself to the issuer, as it would incur for him the payment of the interest rate for holding the bond (Buiter, 2010).

As one might expect, the currency falls into the second category. Therefore, because of its nature, monetary policy makers cannot create and pour a paper currency into the market that bears a negative or even a positive interest rate. From this constraint is resulting the zero lower bound that we are familiar with. Due to the zero lower bound, we might think that a negative interest rate on the deposit account would result in a massive withdrawal of assets from the bank to convert the money in paper currency (Svensson, 2003). Hence, the debate among economists over the zero lower bound and its binding constraint.

1.3 The Zero Lower Bound

Although the subject of taxing money and, de facto, putting a negative interest rate on money emerged decades ago, it was still discussed among economists till the present days.

The greater debate is focused on the zero lower bound. On the one hand, according to McCallum (2000), even at the zero lower bound, central banks can affect the inflationary expectation using their monetary policy. Furthermore, it has been demonstrated that the medium and longer term are still responsive to announcement of future monetary policy when short

interest rates are near the lower bound (Swanson & Williams, 2014). However, it must be mentioned that this effect is relatively brief (Wright, 2012).

Ullersma (2002) summarises the argument in favour of the preserving of the zero lower bound as a problem of confidence. Indeed, the real issue with the zero lower bound is not its binding effect, where, hypothetically, central banks' monetary policy is less effective, but rather with the loss of confidence by the market players. Central banks must design a credible monetary policy strategy in order to raise inflationary expectations. Otherwise, right after accommodative measures, market players would simply hoard their cash due to the lack of confidence in the economy. This monetary policy can also be coupled with structural reforms as well as expansionary budget policies to boost the general confidence of consumers (Ullersma, 2002).

1.3.1 Overcoming the Zero Lower Bound

In contrast, strong arguments against the zero lower bound have emerged since the long Japanese economic stagnation/deflation. Indeed, as Goodfriend (2000) discussed it in various articles (Goodfriend, 1997; Goodfriend 2007), the zero lower bound should be removed with the aim of enhancing the monetary policy of central banks. In his articles, Goodfriend describes the zero lower bound as a barrier for monetary policy as once were the Gold Standard and the Fixed Foreign Exchange Rates.

The Gold Standard is a commitment emerging from the engaged countries to set the prices of their domestic currencies in function of a specified amount of gold (Bordo, 1981). Under it, the price of goods is a function of the money price of gold and the gold price of goods such as (Goodfriend, 2016):

$$\frac{\text{money}}{\text{goods}} = \frac{\text{money}}{\text{gold}} * \frac{\text{gold}}{\text{goods}}$$

Following this standard, a rise in the amount of gold needed to buy a good, the second term of the right-hand side equation, would cause inflation and vice versa. Consequently, the money price of goods is linked to macroeconomic factors affecting the gold industry. In this scheme, central banks would have to buy or sell gold in order to have a price stability in addition to adjust the level of interest rates. Hence, the standard was ended in 1933 in the USA and a quasi-standard continued for approximately 40 years until President Richard Nixon fully cut the tie

between the dollar and the gold. Furthermore, the Fixed Foreign Exchange rate was abolished during the same era in favour of a floating exchange rate in order to reflect the changes in the international terms of trade (Goodfriend, 2016).

1.4 Buiter's Three Ways of Overcoming the Zero Lower Bound

1.4.1 Gesell's Negative Interest Rate

The first means to overcome the zero lower bound is the carrying tax on cash. This concept was first introduced by the theoretical economist, successful businessman and social activist Silvio Gesell in his famous idea of the “Freiegeld” (free money) (Ilgmann & Menner, 2011).

1.4.1.1 The Fundamental Interest Rate

To better understand this concept of free money, we must look at the properties of money, those of goods and their relation. The former is intrinsically exempted from the effects of time. Indeed, when you forbid yourself from spending your cash and keep it safe in your home, it doesn't deteriorate. Gesell explains that it is the main feature of money, it is exempted from carrying charges. Moreover, money is the only good that you must have in order to buy all other types of goods. On the other hand, the producers or the holders of goods are forced to sell their merchandise or it won't worth anything in the future. In other words, the longer you keep your loaf of bread on your shelf, the less value it will have. As Preparata and Elliot (2004, p. 936) say: “*Goods perish, rust and rot. Time consumes both humans and merchandise mercilessly. All things material perish. But one thing does not, and this is money.*” Hence, the hoarders of money have a strategic advantage compared to the holders of goods. They might decide to restrain themselves from buying goods and steadily let the value of goods decreases over time. Because money doesn't have carrying charges, the producers of goods are willing to pay a surplus to give an incentive to money holders to buy products (Gesell, 1958). This is what Gesell called the fundamental interest rate or the tribute (Blanc, 2002).

Therefore, according to Gesell, the only way to promote the circulation of money is not by abolishing the fundamental interest rate but rather by applying a tax on hoarding your cash for extended periods of time (Blanc, 2002).

It is important at this point to discuss the viability of this tax. In a world where there are no costs associated to hoarding cash or it can be neglected, a market player will always prefer to sit on his coins and notes rather than providing/depositing money if the interest borne is inferior to zero (Hicks, 1937). However, as discussed by Buiter and Panigirtzoglou (2003), although the cash is not bounded by time in a specific value/time relation, you incur a cost of storing your money. The costs can take several forms: the cost associated with the physical storage, the cost of insuring your money against the possibility of theft and damage as well as the insurance against the loss of money. Therefore, the investors would have an incentive to use or lend their money instead of simply putting it under the mattress if the tax is equal or lower to the cost of hoarding cash (Kiselak et al., 2016).

Nonetheless, it has been argued that these costs are relatively small for small businesses and households as opposed to the cost faced by corporations and financial institutions (Jobst & Lin, 2016). Moreover, the negative interest rates or the tax on money bring up a psychological barrier for the common investors. Indeed, as mentioned by Asterlind et al. (2015), even a low negative interest rate could cause customers to withdraw their money from their deposit accounts because of the paradox of being charged for saving money. This effect could occur because the carrying costs are not directly noticeable as opposed to a negative deposit rate. Moreover, it has been argued that there is a probability of a phenomenon of “loss aversion”. This phenomenon states that market players have a stronger negative feeling towards certain losses compared to probable profits. Hence, investors are willing to invest in riskier assets with the aim of avoiding a quasi-certain negative return (Asterlind et al., 2015).

1.4.1.2 The Fischer's Stamp Scrip

Gesell idea was developed and used in later years by Fischer who analysed the impact of taxing the money on several North American cities (Fischer, 1933). Although the stamp scrips were not seen for the first time in the United States of America, it is interesting to have a closer look on this particular matter because it shares common points with the situation we are now facing 80 years later.

During the Great Depression, money was a scarce resource. The Americans, afraid since the sudden collapse of their economy, began to withdraw their money from their deposit accounts. These actions forced banks all over the country to restrict or completely forbid the withdrawal of money while they tackle the problem of illiquidity. Moreover, people stored their

cash instead of spending it or putting it in their deposit account which aggravated the situation of money scarcity (Champ, 2008). While consumers are accumulating their cash, the price of goods is falling which is an incentive to consumers to keep on hoarding their cash. In other words, the more you wait, the more valuable the money gets and the cheaper the goods will be. Hence, in order to avoid this deflationary spiral, Fischer supported the issuance of stamp scrips. According to Fischer, the stamp scrip: *“offers the most efficient method of controlling hoarding and probably the speediest way out of a depression.”* (Fischer, 1932, p. 142)

The stamp scrip would take several forms and spread over the United States. By simplicity of explanation, we will only discuss the stamp scrips issued by local municipalities as a means of exchange. Typically, one side of the stamp scrip would resemble as a traditional dollar note (see Appendix 1). The value could range from \$1 to \$5 stamp scrip. The other side of it is composed of a row of 52 boxes, which are a reference to the 52 weeks within a year. The boxes allow room for a small stamp with a date on it to be glued on the box. In order to exchange the stamp scrip against some goods, you must have the stamp of the current week on the corresponding box (Gatch, 2008). The seller of goods can refuse a stamp scrip that has not been correctly stamped. If you are in the situation where you accepted a stamp scrip that was not correctly dated, you are at fault and you must make up for it (Fischer, 1933).

Therefore, each week on Wednesday, a stamp costing 2 cents to 5 cents has to be bought and put on the stamp scrip to make it a valid commodity for trading. Once the scrip is correctly dated, it will be freely exchanged during the forthcoming week as if it was actual money. In this situation, the stamp scrip becomes a sort of money time bomb. Nobody wants to be the last holder of stamp scrip at the end of the week and be “forced” to pay the 2 cents for the new stamp (Champ, 2008).

Hence, the stamp scrip holds a double advantage. On the one hand, it is like money because it can be used to purchase goods and commodities. On the other hand, it is not like money because it cannot be hoarded without facing the risk of paying a tax (Fischer, 1933). Moreover, as there might be several cases in which you don’t fancy buying or aren’t required to purchase perishable goods, the stamp scrip still offers the possibility to invest in companies, land, etc. At the end of the year, the stamp scrip is returned to the local municipality with the 52 stamps on it as a compensation for the administrative and logistical costs of operating a scrip currency (Fischer, 1933).

1.4.1.3 Mild Success of the Stamp Scrip

However, stamp scrips were not as successful as one might imagine. Indeed, this mechanism relies heavily on the co-operation of merchants and sellers. For instance, in Multnomah County, out of the one million dollars that were supposed to be poured into the county's economy, only a mere \$52,000 was actually printed due to the lack of participation of large companies. Moreover, the success of stamp scrip is decided by the support of the stakeholders, namely the consumers, of the area where they are putted in circulation (Gatch, 2008).

Furthermore, the stamp scrip is bound to be used on a local scale, raising problems to buyers who want to purchase goods outside the community or the county. It was less of a concern for people of the community who understand the positive impact of the stamp script. They could afford to buy most of their products locally and, consequently, support the community through the stamp scrip. The merchants, on the other side, must acquire large quantities of products that can't be bought on a local scale. Hence, the local nature of the stamp scrip was, and still is, a strong barrier against its usage for merchants. (Elvins, 2005).

1.4.2 Abolishing the Currency

Another means of overcoming the zero lower bound is to withdraw the paper currency from the economy. Instead of using physical currency, market players will purchase goods and services with an electronic currency. The idea emerged from the famous economist Milton Friedman who advocated for the abolition of cash (Warwick, 2011). By replacing coins and currency via electronic transactions, every transaction can be traced and kept in a record book. Thus, the daily purchases would no longer be made with bearer instruments, or unregistered instruments.

This system brings multiple advantages. First, there will be no restrictions regarding the interest that can be set on the "currency". Hence, the central bank could set a negative interest rate on the electronic currency. Secondly, by diminishing the cash in circulation in favour of a traceable currency, the government would actively fight against violent crime rate. Robbers and thieves would be deprived from the benefits of committing a felony. Moreover, crime organisations such as drug cartels or human trafficking organisations won't be able to continue their activity due to the impossibility of money laundering and over the counter transactions. Finally, it would greatly diminish the amount of undisclosed revenues (Warwick, 2004).

However, although this monetary policy brings several advantages, there are four main drawbacks. Firstly, Buiter (2010) analysed that the part of the population who is heavily relying on paper currency are households with limited income. These households purchase goods and services by using physical currency instead of making transfers via electronic currency. Secondly, the economy is not immune to the probability of an electronic system failure. Moreover, the threat of an electronic warfare has been increasing since the advent of the Internet. Governments are facing a risk of a complete deregulation of their electronic currency in case of a cyber-attack. Hence, the paper currency would act as a backup system in this eventuality. Thirdly, with every transaction being traceable, we are facing a situation of privacy intrusion. The society could be highly averse to a world where every purchase they make is recorded and the record is kept for an undetermined period of time. Fourthly, in times of crisis, another psychological factor might erupt. Market players could refuse to cash in electronic currency because of the loss of confidence in the economy (Ilgmann & Menner, 2011).

1.4.3 Unbundling the Numéraire from the Currency

The original idea of having two currencies is attributed to Eisler (1933). In order to grasp the idea behind this strange concept, it might help to imagine a theoretical framework used by Buiter (2005). Assuming England has the sterling as its currency, the first move that should be performed by the Bank of England is the retirement of all paper notes and coins denoted in sterling. Therefore, the sterling currency only exists on an intangible aspect. This electronic sterling will still serve as the numéraire for the wages, the bank deposit units and all prices. Furthermore, the Bank of England will pursue its objective of price stability for the sterling price index by changing the short-term sterling interest rate. In addition to retiring the sterling, the Bank of England creates a new currency, say the *knaep*, to take on the previous job of the sterling. The *knaep* is used only as a legal tender for exchange purposes. Due to the physical feature of the *knaep*, it is bounded by the zero lower bound (Buiter, 2005). Hence, the interest rate on the *knaep* cannot be negative.

With these two currencies, the central bank has three rates that it can set: the short-term sterling rate, the spot exchange rate between the sterling and the *knaep* and the forward exchange rate. Hence, because the sterling is no longer bound by the zero lower bound due to its electronic characteristic, the Bank of England can set a negative short-term sterling interest rate. This negative interest rate will be conveyed on the deposit accounts of Britons. In the

meantime, the central bank must constantly depreciate the new currency (the *knaep*) against the sterling, using the two exchange rates, with the aim of preventing a flight to the physical money. The rate of depreciation has to be of the same magnitude as the negative interest rate applied on the electronic currency (Ilgmann & Menner, 2011).

The theory of unbundling the numéraire from the currency faces two criticisms. First, the choice of the numéraire by the government. Indeed, there is a lack of theoretical background to determine which unit of account should be used as the numéraire and who is technically competent to determine it. For the purpose of understanding the unbundling of the numéraire, it has been arbitrarily chosen that the unit of account would be the sterling. However, the numéraire could be anything from a former physical currency to an entirely new currency. Secondly, because of the lack of practical testing, it is uncertain that the central bank would develop its monetary policy in order to achieve a price stability in terms of the numéraire instead of the new legal tender (Buiter, 2005).

Chapter 2 The ECB and the Negative Interest Rates

After introducing the negative interest rates and their origins, we will analyse which instrument the ECB has set into the negative levels and the situation that pushed it to do so. Then, we will discuss the purposes of the negative interest rates, their benefits, and disadvantages through the various channels they are transmitted. This discussion could give us a first insight on the impact of the negative interest rates on the profitability of European banks.

2.1 REFI, Deposit Rate and Credit Rate

The European Central Bank controls three interest rates: the refinancing rate (REFI), the deposit facility rate and the credit facility rate. The REFI is the central rate of the ECB. Indeed, it serves as the minimal rate for the refinancing operations among the European credit institutions, namely the main refinancing operations (MRO) or the long-term refinancing operations (LTRO). On the one hand, it informs market players on the monetary policy designed by the ECB. On the other hand, this minimal rate steers the Euro overnight index average (EONIA). The EONIA is the rate at which banks inside the Euro zone lend to each other on an overnight period. Indeed, prior to the crisis, the rate on the overnight market liquidity was oscillating near the MRO's rate (ECB, 2016b). Eventually, it impacts the rates applied in the market and on the loans of banks' customers. The REFI is bounded by the deposit facility rate, which is the lower bound, and the credit facility rate, which acts as the upper bond. The deposit facility allows financial institutions to deposit their money at the ECB for a duration of 24 hours while the credit facility gives the possibility to banks to borrow money for the same period. In the ECB case, only the deposit rate has been cut to negative levels (Blot & Hubert, 2016).

2.2 Situation for Negative Interest Rates

In June 2014, in response to low inflation and the strong probability of falling into a liquidity trap, the ECB decided to lower the deposit rate into the negative area. As a first dip into the negative waters for a major central bank, the ECB cut the deposit facility rate to -10 basis points. Furthermore, the ECB continued its operation of lowering the deposit rate to -20 bp in September 2014 and even to -30 bp in December 2015 (Bech & Malkhozov, 2016). At the time this master thesis is written, the deposit rate is at -40 bp (2017).

It is important at this point to explain the specific situation that encouraged the European Central Bank to set the deposit facility rate under the infamous zero lower bound, following the idea of Gesell that the effective lower bound is not at zero percent but somewhat around -0.5% (Witmer & Yang, 2016). Moreover, as opposed to the mainstream thinking about the NIRP purpose of solely giving an incentive to increase the credit supply, lowering the deposit facility rate has an impact on multiple instruments.

2.2.1 Credit Crunch

Banks use the ECB as their main bank. The accounts that they have at the ECB are called the reserves. Financial institutions must have minimal reserves, set by the European regulatory program, in order to maintain financial stability. The excess reserves, which banks may have, are also deposited at the ECB's deposit account. It is important to point out that excess reserves can only be detained by financial organisation that have an account at the ECB. In normal times, financial institutions, acting as rational economic agents, would only have the minimal required reserves because loans would grant a higher return than the deposit facility rate. Therefore, the liquidity surplus from one bank would be traded to a bank with liquidity needs on the interbank market (Blot & Hubert, 2016).

However, as Vollmer and Bebenroth (2012) have stated, during a financial crisis, the interbank market is deeply impacted. Banks rely heavily on the deposit and credit facilities of central banks instead of dealing on the interbank market. In this situation, the central banks must replace the interbank market to prevent a collapse of the banking industry due to a liquidity shortage. This event, called the credit crunch, can be caused by two factors: either by the increases in the aggregate credit risk or by the increases in the liquidity risk.

2.2.1.1 Credit Risk

The credit risk can be defined as the risk the counterpart to which a financial institution has granted a loan or did business with won't be able to fulfil its engagements (BIS, 2000). A situation where the aggregate credit risk increases means that the probability that a counterpart will meet its obligations decreases. As this risk soars up, the interbank interest rates increase, forcing safer banks to exit the interbank market which will cause a further increase in the

interbank interest rates. Hence, given the excessively high interest rates, liquidity seeking banks must find an alternative lending facility to access liquid assets (Vollmer & Bebenroth, 2012).

2.2.1.2 *Liquidity Risk*

The liquidity risk arises from a probability of not being able to trade its assets or services against other assets promptly enough in order to avoid a variation of their market price (Nikolaou, 2009). An increase in aggregate liquidity risk is: *“a situation in which participants in the interbank market perceive either a decline in the quality of available collateral or an increase of the probability of a liquidity outflow in the near future.”* (Vollmer & Bebenroth, 2012, p. 55). Therefore, financial institutions are averse to lending to each other because of the increased fear of not being able to be sufficiently liquid in the short term. As a result of the bubble exploding, banks had to de-lever their balance sheet which consist of massive sales of their assets (Pedersen, 2008). However, as cited earlier, the concerns about a liquidity shortage and the ability to meet liquidity ratios have forced banks to restrain themselves from extending their loan volume. On the contrary, banks have hoarded their cash during the financial crisis (Strahan, 2012).

Furthermore, the increases in aggregate liquidity risk and in aggregate credit risk affect both the consumers and the non-financial corporation. Indeed, in the United States, the loans granted to sizeable non-financial companies dropped by 47% during the pinnacle of the financial crisis (Ivashina & Scharfstein, 2010). The same results have been observed for the consumers in the USA with falls of approximately 6% and 10% for the total household debt and the debt-to-income respectively (Gropp, Krainer & Laderman, 2014). According to a study from Cornett et al. (2011), banks provide liquid assets to their customers but in return those same banks acquire illiquid assets through the granting of loans. Furthermore, banks must provide liquid assets on demand because customers have the right to withdraw money from their deposit account at any time, unless the bank has special restrictions such as those implemented during the Great Recession. Consequently, banks must shield themselves against the risk of being illiquid in the short-term by restraining their loan volume.

Nevertheless, the demand side of the credit has also decreased following the financial crisis. Balance sheet of banks are impacted after a crisis as well as the balance sheet of other economic agents. Therefore, companies have to reduce the size of their balance sheets as well which translates into a lower demand for debt. Moreover, the financial conditions discouraged the

consumers to borrow money due to the high interest rates applied on loans (Krainer & Laderman, 2014).

However, it has been proven that the decrease in the credit growth is in majority attributed to a tightening of credit supply rather than the fall in credit demand. Indeed, consumers are more often restricted by the credit crunch than financial institutions (Mac an Bhaird, 2013).

2.2.1.3 Extension of the LTROs

In normal times, the ECB allocates the amount that will be bid on in the MROs and the LTROs so that it meets the expected aggregate demand for liquidity in the market (ECB, 2016b). The key advantage of these types of operations is to “liquidize” illiquid assets. The MROs and LTROs require a collateral in exchange of the credit. Therefore, banks with sovereign bonds can use them as collateral with the aim of acquiring liquidity (Barr, 2012). On average, the amount set by the ECB on the LTROs were around €45 billion which only represents approximately 20% of the liquidity offer of the ECB (Kuepper, 2016).

Following the increases in aggregate credit risk and in liquidity risk, with the purpose of avoiding the collapse of the banking market, central banks created an extensive amount of liquidity by being the lender of last resort. Indeed, The European Central Bank has extended the maturity of their long-term refinancing operations as well as the amount of these. In March 2008, the ECB offered longer term refinancing operations (LTROs) of €25 billion with a maturity of 6 months. It represents a two-fold increase in duration in comparison with the usual 3 months maturity (Cour-Thimann & Winkler, 2013). In addition, the ECB conducted two LTROs with a maturity of 3 years and with an interest rate of 1%. The first one had taken place in December 2011 while the second one was introduced in February 2012. The combination of the two LTROs amounted to €1,018.7 billion for European banks (Jeffery, 2013).

Furthermore, in 2014, the ECB launched a new set of long-term refinancing operations: the targeted longer-term refinancing operations (TLTROs) (ECB, 2014). The main difference with the previous longer-term refinancing operations is the amount that a bank can borrow. The amount allowed is based on the bank outstanding loans to non-financial enterprises and households. Indeed, banks can borrow up to 7% of their eligible loans to companies and

households¹. Hence the name targeted longer term financial operations because it is meant to increase the loan volume of banks towards non-financial corporations and households (Eichengreen, 2014). The ECB decided to organise eight TLTROs, each operation being two months apart from each other, from September 2014 till June 2016 (ECB, 2015).

Finally, the ECB launched in 2016 a new version of the targeted longer term financial operations (TLTROs II). These operations differ from two aspects from the previous series of TLTRO. Firstly, the percentage that financial institutions can borrow relative to the eligible loans went up from 7% to 30% (Gros et al., 2016). Secondly, the programme gives the opportunity to financial institutions to finance themselves at an interest rate which is a function of the evolution of the loan volume of the bank itself. As a bank increases its loan volume by 2.5% within two years following the acquisition of the targeted longer-term refinancing, the cost of borrowing will drop as low as the negative deposit rate currently set by the ECB on its deposit facility (Tahiri & Six, 2016).

2.2.1.4 *Hoarding of Cash*

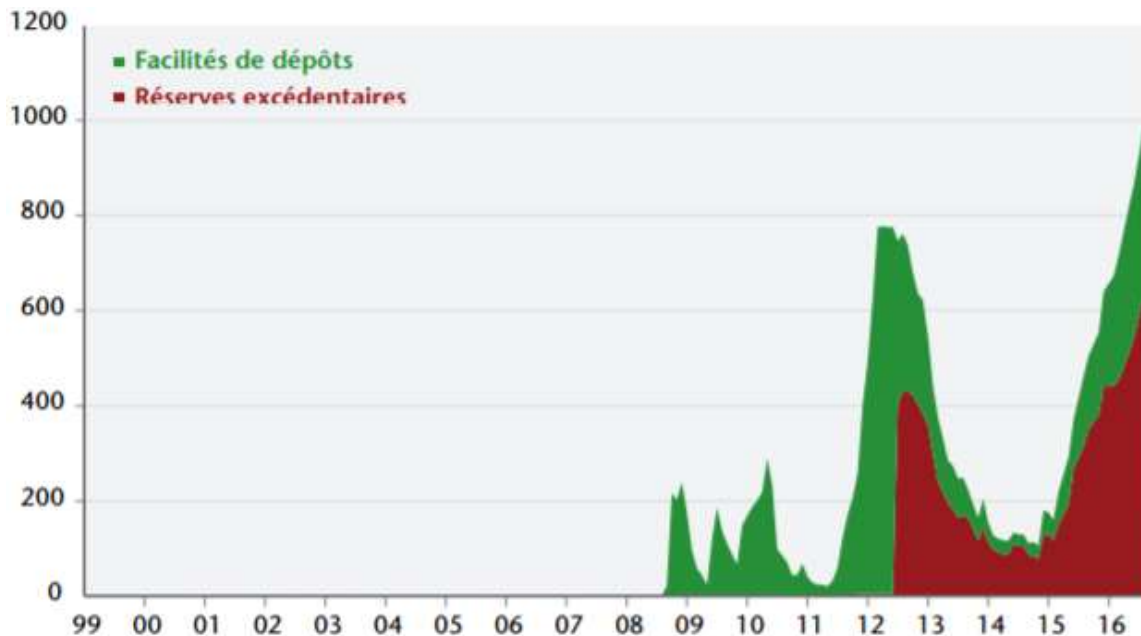
These operations would allow banks to refinance themselves at a lower rate than the ones applied in the interbank market. Due to these better credit conditions, the ECB would stimulate the financial institutions to grant in turn loans to non-financial companies and consumers. Moreover, the interest rate on the loans granted by the banks would be low, which is an incentive for consumers to borrow money in order to purchase assets. Therefore, these operations would increase the demand and the supply of the credit activity. As it was demonstrated by Carpinelli and Crosignani (2017) using the Italian credit registry, the LTROs had a positive impact on the credit supply, increasing it by 2% after the injection of liquidity in European banks.

However, financial institutions didn't increase significantly their loan volume after the refinancing operations. Instead, the banks have parked much of their newly acquired liquidity in the deposit facility of the ECB. As Peshev and Beev (2016) exposed, the excess reserves in the ECB accounts have sharply surged since 2008 with the exception of a quick decrease in

¹ Eligible loans are loans granted to companies and households which reside in the European zone. The mortgages are excluded from these eligible loans (ECB, 2014)

2014 (see Fig. 3). Due to the extensive amount of excess reserves banks had, the ECB used another unconventional monetary policy: the negative interest rates.

Figure 3: ECB's deposit facility and excess reserves (€ bln., 1999-2016)



Source: Blot & Hubert (2016) based on ECB Data

2.3 Purposes of Negative Interest Rates

The negatives interest rates have the same purpose as any monetary policy of the ECB: ensuring a price stability in the Euro zone. As mentioned earlier, expectations of decreasing inflation were rising among European economic agents. Therefore, the ECB has designed this monetary policy with the aim of raising the inflation expectations of European market players as it was explained by the President of the European Central Bank, Mario Draghi, in a speech in Frankfurt on November 2014: *“It is essential to bring back inflation to target and without delay.”* (Spence, 2014, para. 3).

While the rising inflation is a sub-optimal objective, the ultimate goal of the ECB is to increase short-term growth through price stability (ECB, 2017a). We can analyse the impact of the negative interest rates through five channels: the credit channel, the asset valuation channel, the exchange rate channel, the interest rate channel and the portfolio balance and risk-taking channel (see Appendix 2).

2.3.1 Interest Rate Channel

As it has been mentioned in the first paragraph of this chapter, the ECB controls the REFI which impacts the rates applied in the market. Remember that the REFI is bounded by the deposit and the credit facility rates. Therefore, if the deposit rate decreases, the REFI will inevitably plunge as well.

Once the REFI has decreased, the policy rates applied by banks on a wide range of commercial instruments will follow the same path as the reference rate. Indeed, the rates on deposit accounts, consumer loans and even mortgages will decline through the term structure expectations which states that the long-term interest rates are the short-term interest rates in the future. Hence, the cost of borrowing will be lowered which is an incentive for consumers to borrow, spend, and invest rather than deposit their cash on deposit accounts with a low interest rate (Bank of Canada, 2012). Moreover, because of the decrease in interest rates, the credit risk decreases as well. Indeed, there is a positive correlation between the probability that a loan becomes non-performing and the loan interest rate. When the rates applied on bank loans decline, the solvability of customers, which translates in their ability to repay the interest or the principal, increases. Thus, a potential loan that was once considered unattractive for financial institutions because of the high counterparty risk becomes an opportunity in low interest rate environment (Blot & Hubert, 2016).

Nevertheless, a survey conducted by ING (2016) established that only 38% of the 13,000 consumers across Europe who were interrogated save less due to the low interest rate environment². Furthermore, the surveyors emphasise that this decrease in savings does not necessarily translate into spending more in the economy.

Moreover, it has been observed that the negative interest on the deposit facility of the ECB has not been passed on the deposit facilities of bank's customers. Indeed, financial institutions are averse to the thought of imposing negative interest rates to their customers. This thought is perfectly reasonable as nearly 80% of ING customers would withdraw the money out of their deposit accounts if the rates on these deposit accounts are negative (ING, 2016). In addition, Waller (2016) discussed the possibility of banks increasing their loan and mortgage rates with

² Given the low interest rate environment, the rates on the saving accounts of banks' customers are also low which gives an incentive to those same customers to operate a transfer of the money on their deposit account to investments that bear a higher return.

the aim of mitigating the negative effects that the negative interest rates could incur on the profitability of the financial institutions.

The combination of the two effects could drastically impact the transmission mechanism of the ECB's monetary policy. Furthermore, although the ECB can impact the long-term interest rates through a change in the short-term nominal interest rates, it is argued that the impact is relatively limited (Bernanke & Gertler, 1995).

2.3.2 Credit Channel

With ECB's deposit facility rate being lower than the zero lower bound, the banks are confronted to a choice regarding the liquidity they dispose of. On the one hand, they lend to companies and households and they purchase assets. On the other hand, they decide to stockpile their liquidity in the deposit facility of the ECB. While the first option is supporting the economic recovery, the second one is obstructing the monetary policy designed by the ECB (ECB, 2016b). As Blot & Hubert (2016) state, the financial institutions are facing a situation similar as if the deposit rate was in the positive territories. Indeed, if the interest rate on the deposit facility of the ECB is 0.6% and the reference rate is 1%, the interest margin if banks grant loans instead of hoarding their cash is 0.4%. This scheme is the same if the deposit rate is -0.4% and the main refinancing rate is 0%. Nevertheless, it should be mentioned that in normal times when the interest rates are positive, the excess reserves of banks are quasi non-existent (Blot & Hubert, 2016).

2.3.3 Asset Price Channel

Given the low interest rates, the price of assets has significantly increased. The asset prices are based upon the Discounted Cash Flow Model (DCF). Once the interest rates are low, the discount factor decreases as well, boosting the value of the expected cash flow generated by the asset. Furthermore, additional monetary policy easing could boost the expectations of stronger growth. Hence, these expectations will be translated into higher expected cash flow which will also increase the asset prices (Hannoun, 2015).

2.3.4 Portfolio Balance and Risk-Taking Channel

The negative interest rates forced banks to reallocate their portfolio. Indeed, as the yield on safer assets such as sovereign bonds fell into the negative levels, banks have the incentive to invest in assets that are riskier or with a longer duration. This portfolio rebalancing will eventually support growth (Bernanke, 2016). However, the shift from “safe” assets towards riskier assets can result in a bubble. Indeed, because market players are buying riskier assets in larger amounts, the interest rates on them is lowered. Thus, the spread between safe and risky assets is narrowing (Arteta et al., 2016). Furthermore, since the second quarter of 2014, the effective duration of euro-denominated debt has sharply surged, exposing investors to a considerable interest rate risk. Hence, if the interest rates were to get back to normal levels, the investors would incur significant and broad losses (Hannoun, 2015). Finally, Hannoun (2015) stated that the negative interest rates didn’t boost the investments in the real economy but rather it drove investors to take on more risk in the financial markets.

2.3.5 Exchange Rate Channel

The monetary policy will also influence the exchange rates between the foreign currencies and the euro. As interest rates in the Eurozone are lower than the interest rates in foreign regions, the economic agents are reallocating their resources towards foreign investments which are denominated in a foreign currency. Hence, the attractiveness of the euro decreases which will cause the depreciation of the euro towards foreign currencies. Through this depreciation, the capital inflows are decreased in favour of net exports (Blot & Hubert, 2016). Nevertheless, we face the risk of a currency conflict resulting from the depreciation, at the same time, of several central bank currencies (Arteta et al., 2016).

Chapter 3 Banks' Business Models

Through the various channels that the negative interest rate policy is transmitted, we can detect that the profitability of banks can be shaken following the implementation of the NIRP. Therefore, we shall scrutinise the different sources of income that a financial institution uses in order to generate a profit and the factors that influence the height of the income produced. Furthermore, since the crisis, a new set of standards for bank regulation has emerged. This new set of standards has been putting pressure on financial institutions due to the larger capital requirements. Hence, we will analyse the new set of reforms and discuss its impact on banks' profitability. Then, we will present the research done on the profitability of European banks with an emphasis on the evolution of the profitability of three business models. Finally, we will talk about the studies on the impact of the negative interest rates policy on the profitability of the European banking industry in its whole.

3.1 Banks' Sources of Income

3.1.1 Net Interest Income

The traditional function of a bank is described as being the intermediary between economic agents with a surplus of liquidity and those with a deficit or a need of liquidity (Moore, 1989). More specifically, banks will borrow money from market players such as other banks, wholesale customers or households on a short-term basis and lend the acquired fund to other market players on a longer-term basis. In other words, the liabilities of the financial institutions are linked to the short-term rates while the bank's assets are more related to the long-term rates (English, 2002). Therefore, the net interest income is the difference between what borrowers have to pay for their loans and mortgages (i.e. interest income from earning assets) and what lenders eventually receive for the "investment" they have made into the bank (i.e. interest expenses from earning liabilities). The net interest income is considered by many financial agents as the main source of profit for most banks (Busch & Memmel, 2014). Nevertheless, DeYoung and Rice (2004) demonstrated that the non-interest income for US commercial banks has soared up from 20% of the total operating income to nearly 50%³ in the years 2000.

Extensive literature has explored the conditions and variables that influence the net interest income. Maudos and Fernandez de Guevara (2004) summarise those in 10 factors based on the

³ The total operating income is the sum of the non-interest income and the net interest income

dealership model of Ho and Saunders (1981). The first seven factors are considered as the pure spread factors that justify the net interest margin. The net interest margin is the difference between the interest income of earning assets and the interest expenses of liabilities divided by the total assets of the bank (Gischer & Jüttner, 2003). However, there are other factors that alter the pure interest rate margin, which are synthesised in the three latter factors:

- a. The competitive market structure: Economies with lower restrictions and entry-level barriers will foster a market where the competition is increased. Thus, the level of interest rates will decrease which represents a negative impact on the net interest margin of banks (OECD, 2010).
- b. The average operating costs: The higher the operating costs of a financial institution, the higher the interest rate it will apply on its lending instruments with the aim of covering these costs. Hence, there is a positive relationship between the average operating costs and the net interest rate margin (Maudos & Fernandez de Guevara, 2004).
- c. The risk aversion: Risk aversion is of great significance to support the existence of the net interest margin. Angbazo (1997) describes two key justifications concerning the risk aversion of financial institutions and the net interest margin. Firstly, in the financial sphere, there are the unpredictability of liquidity flows, emerging from the nonsynchronous events between borrowers' loan needs and the customers' deposit inflows, as well as a preference of both to fulfil these needs by borrowing or lending by means of indirect finance because of the costs associated with the direct finance (Gischer & Jüttner, 2003). The bank acts as an intermediary to arbitrage up to a degree which is determined by the level of risk aversion of the financial institution. Indeed, banks charge a fee in addition to the risk-free interest rate and deduct a deposit-taking fee from the risk-free interest rate, which are in accordance with their risk aversion, to compensate for the credit risk that banks bear and the immediateness. Thus, banks lacking risk aversion would not have a large interest margin because these banks would not require a risk premium in order to shield themselves against the unpredictable deposit arrivals and loan needs. Moreover, the arbitrage would reduce most of the interest margin. In this situation, the only variables that a risk neutral bank would take into consideration are the operating costs and the market power.

Secondly, the existence of the risk aversion defines the size of financial institutions. Risk-neutral banks would extend their arbitrage volume up to the moment where the net interest margin is disappearing. Moreover, it ensures the presence of instruments without risk in the short-term market. Angbazo (1997) pointed out four determinants that influence the risk aversion behaviour in financial institutions:

(1) management's inability to diversify its human capital; (2) insufficient owner diversification; (3) incentive problems such as moral hazard and adverse selection which are associated with government regulation (e.g., deposit insurance, failure resolution mechanism, etc.). These regulations in turn require banks which enjoy protection to limit risk; and (4) Bankruptcy cost resulting from partial or complete default. Angbazo (1997, p. 58)

Nishiyama (2007) has analysed to what extent banks are averse to risk. In his findings, he demonstrated that banks are indeed risk-averse but only to a slight extent (near the risk neutrality). The higher a bank is risk-averse, the higher it will charge a compensation in terms of interest rates on its loan instruments because of the greater cost they have to bear from financing themselves on the equity side of the balance sheet liabilities. Hence, all things being equal, we can deduce a positive correlation between the risk aversion and the net interest margin (Maudos & Fernandez de Guevara, 2004). However, Poghosyan (2012) looked at the risk aversion from another angle of view. He states that a bank with higher risk aversion would have a lower net interest margin by cause of the tendency to invest in less risky assets which, obviously, bear lower interest rates.

- d. The volatility of money market interest rates: A positive relation exists between the net interest margin and the volatility of money market interest rates. While the interest rates become more volatile, the financial institutions have to apply higher interest rates in order to reflect the market risk. Indeed, as Saunders and Schumacher (2000) evaluated, an increase of 1% in the volatility of interest rates results in an increase of 0.2% of the NIM. Hence, monetary policy makers should focus on stabilising the interest rate through low-inflation policies in order to tighten the net interest rate margin.
- e. The credit risk: Many analysts agree that the higher the probability of the risk of default of the counterpart, the higher the interest rate on instruments such as loans and mortgages a

bank will set. Thus, there is a positive association between the credit risk and the NIM (Almarzoqui & Ben Naceur, 2015).

- f. The interaction or the covariance between the credit risk and the interest rate risk
- g. The average size of the credit and deposit operations undertaken by the bank: The effects of the size of the activity undertaken by a bank on the interest margin are disputed. On the one hand, under the model of the dealership averse bank, the greater the volume of credits and deposits, the larger the interest rate margin will be. This assumption can be deduced because the larger a credit is granted to a household, a non-financial company or even a financial company, the greater the risk of counterparty default the bank faces. Therefore, financial institutions have to raise their interest rate in order to reflect this increased default risk (Maudos & Fernandez de Guevara, 2004). However, a larger loan allows banks to use economies of scales. Indeed, the great volume of the loan diffuses the operating risks on a broader base which in turn permits financial institutions to lower their interest rates (Almarzoqi & Ben Naceur, 2015).
- h. The payments of implicit interest: Instead of paying direct interest rates on the deposit account of bank's customer, banks can offer free services to their customer which account as a disguised interest rate. Therefore, the financial institutions are able to increase their net interest margin thanks to the payment of implicit interest. (Maudos & Fernandez de Guevara, 2004).
- i. The opportunity cost of keeping reserves: Banks are forced to detain reserves to increase the financial stability of the economy. The interest rates of these reserves are lower than these of the market. Thus, the financial institutions are facing a cost which is the difference between the potential interest rate on loans and mortgages they could have and the effective interest rate they earn on their reserves. The size of the cost is proportionate to the volume of reserves needed and the opportunity cost of these reserves. The larger these two components are, the larger the interest margin has to be in order to compensate (Maudos & Fernandez de Guevara, 2004). This component is especially related to the negative interest rates because they lower the opportunity cost of keeping reserves.

- j. The quality of management: This factor can play a crucial part in the net interest margin because the better the quality of the banks' management is, the better the cost structure of these financial institutions will be. Hence, as a result of a cost-efficient structure, banks can decrease their interest rates on loans and instruments as opposed to banks with a poorer management team, decision-wise (Gischer & Jüttner, 2003).

In addition to these factors, the term structure of interest rates, graphically represented by the yield curve, plays a tremendous role on the net interest income.

Firstly, as mentioned earlier, the liabilities and the assets of a bank are closely related to the short-term rates and the long-term rates respectively. Thus, as the slope of the yield curve is more abrupt, financial institutions will generate a higher net interest income because their loans will bear higher interest rates than their deposits (English, 2002). At the opposite, a flattened yield curve is damaging the net interest income of banks (Alessandri & Nelson, 2015).

Secondly, Cruz-Garcia et al. (2016) and Claes et al. (2017) concluded that a further cut in the interest rates while the rates are already low is impacting much greatly the net interest income of financial institutions in comparison to a reduction of the interest rates while they are high. This effect is due to short-term interest rates being less affected by a cut in the interest rates than the long-term interest rates (Cruz-Garcia et al., 2016).

In addition, a rise in the interest rates also affects the net interest income. Indeed, as the liabilities' rates are adjusting more rapidly to the interest rate change, the net interest income of banks is decreasing in the short-term. However, on the longer term an increase in the interest rates is beneficial for financial institutions (Alessandri & Nelson, 2015; Busch & Memmel, 2015).

Finally, the longer the flat yield curve, the stronger the negative impact on the net interest income of financial institutions. Indeed, previous loans coming to maturity are renewed by loans with a lower interest rate. Hence, the net interest margin is squeezed (Claes et al., 2017).

Given these observations, we can deduce that the net interest income and the interest rates have a non-linear upward relationship (Cruz-Garcia et al. 2016; Claes et al., 2017).

3.1.2 Non-Interest Income

The non-interest income englobes every source of income that is not directly related to the income as seen above. It can be decomposed in four main components: the fees and commissions, the net result of financial operations, the securities income, and the other operating income (ECB, 2000).

- a. The fees and commissions: As its name indicates, banks charge their customers with a wide range of fees on the operations they execute on the behalf of their clients such as underwriting a check, safe-keeping their money in their deposit facilities, providing money in different currencies, allowing international transaction with a credit card, etc.

Furthermore, there is a whole portion of the fee and commission income generated by the banking industry coming from the fees and commissions linked to the management of customer assets. Indeed, financial institutions manage the portfolio of their customers in order to maximise the return with the lowest risk associated. By doing so, banks charge a set of fees to their clients. Firstly, there are the fixed fees or the management fees which are, as their names imply, fixed charges equal to a percentage of the total worth of the portfolio managed. Hence, the fees generated are increasing when the worth of the portfolio is increasing. Secondly, there are the performance fees which are calculated based on the comparison with a benchmark (CFA, 2013).

In addition, financial institutions provide counselling on merger and acquisition as well as capital raising for non-financial institutions and corporations. A set of fees is associated with these counselling activities. First of all, a retainer is paid upfront by the counselled company as it would do it with a law counselling firm. It ensures that the bank gets something, even if the deal doesn't come to an end. Then, the financial institutions receive a success fees once the transaction is made. The success fees are substantially larger than the retainer and are calculated on the transaction worth (Boyte, 2014).

According to a study from the ECB (2000), the fee and commission income represents the largest component of the non-interest income.

DeYoung and Rice (2004) distinguish two sorts of fees: the traditional fee-generating activities and the non-traditional fee-generating activities. They state that the non-traditional

activities have surged since the deregulation of the financial industry. Furthermore, the technological change prior to the financial crisis also forced banks to design new products on which they can charge fees and commissions. Indeed, as mentioned earlier, the market competition is a decisive factor regarding the net interest margin. As the competition is stronger, the net interest margin decreases. This represents an incentive for banks to look for other sources of income.

Recent surveys have studied the volatility of the fee and commission income (F&C income) in order to demonstrate if this source of income can benefit to financial institutions during crisis period. The principal argument in favour of the F&C income is that it is a stable inflow of liquidity because of the fixed characteristic of it. However, Lepetit et al. (2008) found that a bank that is more reliant on F&C income is exposed to a higher level of risk than more traditional banks.

- b. Net result of financial operations: The trading activities of a financial institution are composed of the sales and purchases of securities which are not held as core assets by it. Moreover, it encompasses the operations of price adjustment on these same securities. It represents the second-largest component of the non-interest income (ECB, 2000). The incentive for banks to engage themselves in trading activities arises from the allocation of excess capital that is available for financial institutions. Boot and Ratnovski (2012) described two frictions emerging from trading activities. Firstly, the time inconstancy between the traditional activities and the trading activities. The traditional activities are based on a long-term basis as opposed to the latter that are short-term operations. As a bank allocates an extensive amount of its resources in the trading activity, it might deteriorate the incentive from consumers/investors to construct future relationships with the bank and, in fine, decrease the loan volume. Secondly, the shift from traditional banking towards the sale and purchase operations increases significantly the risk of financial institutions. Furthermore, during 2007-2009, trading activities were negatively associated with the profitability of bank holding companies (King, Massoud & Song, 2013).
- c. The securities income: This source of income emerges from the holding of securities bearing an interest rate such as coupons or dividends. As opposed to the trading activities, the securities are normally held till their respective maturities (ECB, 2000).

d. Other operating income

3.2 Banks' Regulations

3.2.1 From Basel II to Basel III

Following the global financial crisis of 2007-2008, the Basel Committee on Banking Supervision (BCBS), which is responsible for designing prudential recommendations to monitor and strengthen the soundness of financial institutions worldwide in order to ensure financial stability in the global economy, designed a new set of regulatory measures (BIS, 2016). This new set of reforms, the so-called Basel III, will supplement the former Basel II which was deemed to be inadequate to fulfil the task imposed by the BCBS (Rossignolo et al., 2013). However, some criticism still emerged from economists towards Basel III. Moosa and Burns (2013) declared that the Basel III reforms were not a substantial upswing compared to the former set of reforms and, consequently, it won't help financial regulators to avoid a future global banking crisis.

The BCBS stated that Basel III has a threefold goal. First, it is designed so that banks will be able to better withstand financial or economic shocks in the future. Secondly, it is aimed to enhance the governance as well as the risk management of financial institutions. Finally, Basel III will improve the quality of the banks' activity disclosures and reinforce the transparency of them (BIS, 2017). As with Basel II, Basel III is composed of three pillars that are complementary to each other: the Minimum Capital Requirement, the Supervisory Review Process and the Enhanced Disclosure (Discipline of Market) (Vousinas, 2015).

For the purpose of this master thesis, we shall focus our analysis on the first pillar because it might affect the business model of banks and the potential magnitude of their profits in the future. Indeed, the third pillar's purpose is closely related to the reporting and supervision of regulatory institutions but does not require financial institutions to take actions concerning their business model as well as their balance sheet. Whereas the second pillar has no significant impact on banks' profitability.

3.2.1.1 *Enhanced Minimum Capital Requirements*

The first pillar ensures that banks have enough capital to absorb losses emerging from financial or economic stresses. The Minimal Capital Requirements are estimated through credit, market and operational risks. The Minimum Capital Requirements are divided in three parts. The first part is the Tier 1 Capital which is attributed to the going concern capital. As it attribution indicates, the Tier 1 Capital assures that financial institutions have enough capital to maintain their activities during crisis times and mitigate the risk of insolvency. Then, the Tier 2 Capital is the capital allowing a bank to repay their senior debt holder and depositors in the event of its bankruptcy. It is the gone concern capital. Finally, Basel III introduced a new set of buffers that are composed of Common Equity Tier 1 (CET 1) and designed to act as an additional cushion. The buffers take into account the specific position of a bank and the economic situation (European Commission, 2013).

Formerly, the Common Equity Tier 1 of financial institutions had to represent at least 2% of their Total Risk Weighted Assets (RWA). This capital is considered the highest quality of funding that a bank can obtain and should be primarily composed of common shares and retained earnings (Matejasák, 2015). Since Basel III, the required capital ratio of Common Equity Tier 1 soared up to 4.5%, and an Additional Tier 1 Capital (AT 1)⁴ of 1.5% has been introduced. The combination of both capital ratios resulted in a final minimum required Tier 1 capital ratio of 6%. Furthermore, the Tier 3 capital was suppressed in favour of a more harmonised capital ratio of Tier 2 capital which should at least constitute 2% of the RWA. Eventually, the Total Minimum Required Capital of a financial institution amounts to 8% of the Total Risk Weighted Assets. Therefore, Basel III enforces banks to enhance the quality of the funds they detain.

Besides the changes operated in the Tier 1 and Tier 2 capital ratios, the BCBS developed three capital buffers: the capital conservation buffer, the countercyclical capital buffer and a buffer for Global Systemically Important Financial Institutions (G-SIFI).

The capital conservation buffer prevents the loss of capital linked to the minimum capital requirements. This buffer is set at 2.5% of the RWA and can be built up through the retaining of earnings which can consist of limiting the dividends distribution, the buyback of shares or the bonuses given to the employees (Letakis, 2011). Nevertheless, the regulators do not require

⁴ The Additional Tier 1 Capital is composed of instruments that present the characteristic of a perpetual maturity such as preferred stocks and high contingent convertible securities (COREP, 2017).

banks to have a capital conservation buffer if these financial institutions have a sufficient amount of CET 1. Indeed, as a bank has a CET 1 ratio overtaking 7%, it is not required to hoard earnings with the aim of constructing the buffer. On the contrary, a bank with no extra CET 1 in addition to the minimum required capital ratio of 4.5% has to retain the totality of its earnings (BIS, 2011).

Once the capital conservation buffer is breached, automatic actions are taken to reduce the distribution of earnings. It is important to point out that the constraints resulting from the implementation of the capital conservation buffer only affect the distribution mechanism of banks, leaving the operational activities to their discretion (BIS, 2011).

The countercyclical capital buffer plays the role of a safeguard in periods of increased cyclical risk. In good times, the risks tend to increase but the consequences of this surge in risks are emerging in the economy with a significant delay. Therefore, financial institutions should build up a buffer during the good times which will be used when the economy shifts (Drehman et al., 2010). The magnitude of the buffer varies between 0 and 2.5% and will be decided by the competent regulation authorities within each nation (BIS, 2011).

Finally, an additional buffer has been implemented by the BCBS concerning the G-SIFIs. As the failure of one of these banks can deregulate the global economy, the BCBS reckoned that additional high-quality capital should be required from these institutions. Such as the two previous buffers, the amount of additional buffer that a systemically important bank must obtain is directly proportionate to the characteristics of the bank itself. Regarding the SIFI buffer, the financial institutions are attributed a score based on their size, interconnectedness, financial institution structure, complexity and cross-jurisdictional activities. Then, on the basis of this score, they are placed in buckets ranging from 1 to 5. The higher the bucket is, the larger the buffer will be⁵ (BIS, 2014).

Thanks to these additional buffers, the BCBS forced financial institutions to acquire better funds in terms of the quality and in larger quantity. The combine effects of those actions allow banks to better sustain financial stresses.

⁵ The Bucket 5 requires an additional Common Equity Tier 1 of 3.5% of RWA. Currently, no G-SIFI is categorised in this bucket and only two banks are in the bucket 4, respectively Citigroup and JP Morgan Chase (Financial Stability Board, 2016)

3.2.1.2 Additional Liquidity and Solvency Requirements

In addition to the enhanced capital ratio, the BCBS introduced two new ratios in order to strengthen the liquidity position and the solvency of financial institutions.

The first ratio is the Liquidity Coverage Ratio (LCR). It is designed such as the High-Quality Liquid Assets (HQLA) of banks account for more than 100% of their total net cash outflows over 30 calendar days. An asset is qualified as a HQLA if it presents several fundamental characteristics such as low risk, ease and certainty of valuation, low correlation with risky assets and listed on a develop and recognised exchange markets (BIS, 2013).

Secondly, the Net Stable Funding Ratio (NSFR) guarantees that financial institutions are adequately funded by long-term liabilities in regards to the characteristics of their assets and the business they are doing. In other words, it is aimed to strengthen the medium to long-term liquidity of banks. As for the LCR, it is designed to enhance the short-term liquidity of financial institutions and prevent excessive losses during a credit market shock lasting for 30 days (Hartlage, 2012).

3.2.2 Effects of Stricter Regulatory Reforms

Extensive literature has discussed the impact of stricter regulatory reforms on the banks' profitability and credit volume. First of all, an analysis conducted by Härle et al. (2010) estimated that the ROE of European banks would decline by 3.7 to 4.3% considering the direct implementation of the complete package of new regulations and without any attempt by the financial institutions to temper them.

The reasons behind the contraction of the profitability of financial institutions can be multiple. Firstly, due to the higher capital ratios, financial institutions have to extend their equity volume by issuing common share of stocks. Härle et al. (2010) estimated that the aggregate demand for additional Tier 1 capital will amount to €1.1 trillion. In addition, banks will require €1.3 trillion of short-term liquidity and about €2.3 trillion of long-term funding by 2019. In normal times, the yield curve is upward sloping, meaning that instruments with longer maturity bear a higher interest rate. Hence, the cost of capital associated with the common shareholders' equity is larger than common debt cost of capital (Elliot et al., 2012).

However, financial institutions could raise the interest rates on their loans in order to compensate for the higher interest expenses. Súturová and Teplý (2013) calculated that

financial institutions, in order to be compliant with the regulations, would have to increase their loan rates by 54.945 basis points to ensure the same interest rate margin. Nonetheless, the rise in interest of loans would lead to a decline of 2% of the current loan volume which affects the net interest income of financial institutions. Thus, in the end, the banks' profitability is still affected.

Secondly, banks could decide to reduce their amount of loans granted to their customers. On the one hand, by decreasing their pool of risky assets, banks need less capital in order to protect themselves against credit, market or operational risks. On the other hand, as a result of the liquidity requirements (LCR), banks have to cut back their volume of illiquid assets such as loans and mortgages in favour of more liquid assets (Allen et al., 2012). As Elliot et al. (2012) explain, the larger we reduce the size of a bank's balance sheet, the larger we contract its profitability.

Nevertheless, these findings have to be put in regards of the benefits that Basel III brings. Elliot et al. (2012) have found that the costs of Basel III are overtaken largely by the benefits towards the global economy due to a better financial stability. Indeed, banks will gain from Basel III because of the fewer and less important financial crisis. Furthermore, according to the Macroeconomic Assessment Group (2010), the costs associated with the higher capital requirements are spread through the implementation of Basel III till January 2019, which gives financial institutions the time to adapt their business model in order to mitigate the negative impact that the new set of reforms could have on their profitability (higher fees, lower deposit rates, etc.).

3.3 Banks' Profitability

3.3.1 Profitability Evolution of Various Bank Business Models

Following the crisis, financial institutions around the globe revised their business model in the view of three factors. Firstly, as mentioned earlier, the regulatory reforms have made certain type of activities such as the trading ones more expensive for banks. Secondly, in order to be eligible for receiving governmental aid, banks had to reshape their business model with the aim of putting emphasis on the more traditional activities. Lastly, the change in business models can emerge from the wishes of stakeholders or the bank own desire to reflect a more acute version of its risk-return preference (Kok et al., 2016).

In this section, we will analyse the profitability of different business models after the crisis. It is important to point out that the literature is ambiguous towards the strict definition of the business models used by financial institutions because of the wide range of activities a bank can perform and provide. Therefore, for the sake of this master thesis, we shall focus our attention on three main business models: the retail banking, the investment banking and the wholesale banking. We further insist that a bank cannot be strictly categorised as using a special business model. Indeed, in the reality of today, banks are more closely related to universal banks that use several business lines to a certain degree which depends on their managerial choices. Thus, banks described as, for example, retail banks are also involved to a certain extent in wholesale and investment activities.

➤ **Retail banks:** This business model reflects banks that primarily focus their operations on traditional activities which are related to the interest income with a limited exposition to trading activities. Their main source of funding is the deposits received from households and non-financial institutions and they provide, thanks to these resources, loans to consumers (Ayadi et al., 2011). Indeed, as Amadeo (2017) defines, the main missions of the retail banks are: the credit towards the non-financial private sector, providing a secured place for households and non-financial corporations to deposit their money and the management of money such as providing debit cards and checking accounts for customers. Well-known retail banks are Argenta (Argenta, 2017) and Rabobank (ING, 2017a).

➤ **Investment banks:** Banks that generate a high volume of non-interest income thanks to trading securities and derivatives are considered investment banks (Ayadi et

al., 2011). As opposed to retail banks, investment banks provide funds to a firm by buying shares of the firm and reselling themselves to the public or to private investors or on the behalf of the firm. By doing so, investment banks generate a profit from the commission earned on the transaction (The Economic Times, 2017). Furthermore, investment banks are providing a wide range of services to large corporations and financial institutions such as counselling on mergers & acquisitions, financial advisory, underwriting, the research and purchase of private equity investment, etc. They differentiate themselves from retail banks by dealing mainly with large corporations and financial institutions (Financial Times, 2017). Barclays Capital, Goldman Sachs and JP Morgan are recognised as large investment banks worldwide (The Economic Times, 2017).

➤ Wholesale banks: Wholesale banking could be associated with the retail banking as these banks mainly borrow funds and lend them to their customers. The main exception is that they are focusing their activities on larger companies and banks such as government agencies, pension funds and large corporations. (Ayadi et al., 2011). The key advantage for large corporations is that wholesale banks often charge lower interest rates on their loans than retail banks. Nordea Bank is a well-known example of a wholesale bank (Nordea Bank AB, 2017a).

The retail banking has emerged as the most profitable business model during the crisis due to the low-risk activities it engaged in. On the opposite, the wholesale banking has performed far worse in the crisis period (Ayadi et al., 2016). The main reason behind this low profitability is the loss incurred in the trading activities of wholesale banks. Investment banking had highly fluctuating profit during the crisis due to the high trading volume which was not backed adequately with additional capital. However, since the crisis the variability of the returns tends to decrease and the profits of investment banks are slowly surging up (Ayadi et al., 2011).

More recently, Roengpitya et al. (2014) investigated the returns of the three business models. In their findings, they showed that the ROE across all business models have deeply been impacted during the financial crisis. Furthermore, the retail banking has been able to generate stable profit while, on the other side, the performances of investment and wholesale banks have remained volatile.

Sia Partners (2015) conducted a survey on the profitability of Belgian retail banks over the 2013-2014 period. They found out that the performance of the main retail banks in the kingdom has been increasing since the crisis. Furthermore, they concluded that the retail banking will remain the leader of the Belgian banking industry in terms of profitability. However, the banking industry is facing radical changes that the retail banks must respond appropriately to in order to keep this title. The main challenges that retail banks are facing are the customer experience and the need for a client-centric strategy.

As a consequence, we observed a shift from investment banking and wholesale banking towards the retail banking business model. The European Banking Authority (2015) surveyed financial institutions on the sources of funds that they will rely more on in the future. According to their results, more than 50% of the surveyed banks will expand their customer deposit funding while fewer than 10% are expecting to extend wholesale deposit funding. In addition, the majority of the banks will increase their lending activities to SME and consumers in the near future.

According to Roengpitya et al. (2014), the principal shift occurred from the wholesale banking activities to the retail activities. The number of investment banks, indeed, has remained quite constant before and after the crisis. Furthermore, they found that a transition to a different business model could actually have negative consequences to the performance of the bank itself but increase the efficiency of the bank in comparison to its competition.

Nonetheless, although financial institutions have changed their business model to a more retail banking business model, a significant number of banks have diversified their sources of income. Indeed, Kok et al. (2016) calculated that, following the crisis, the European significant banks have increased by nearly 30 percentage point their non-interest income. The difference between the non-interest incomes of the post-crisis as opposed to the pre-crisis is the shift towards fee and commission income instead of securities or investment income (ECB, 2016c). This decision can be supported by the belief of the low-volatility of fee and commission income despite the research done on the subject (i.e. DeYoung & Roland, 2001; Stiroh, 2004; Stiroh & Rumble, 2006). Nevertheless, Stiroh (2004) pointed out that the trading activities are generating a profit that is far more volatile than the fees and commissions.

Finally, in addition to the crisis, the performance of the European financial institutions was deeply affected by the sanctions imposed by banking regulators. Kok et al. (2016) assessed that the net income for the aggregate European banking industry could have been one third larger

between 2008 and 2015 if the penalty amounts European banks suffered were used to build capital in terms of retained earnings.

3.3.2 Impact of NIRP on Banks' Profitability

After assessing the profitability of the banking industry during the last decade, we shall turn our analysis on the recent survey developed in the aim of evaluating the very low or negative interest rate policy impact on the profitability of banks. As Claes et al. (2017) stated extensive literature can be found on the effect of a change of interest on the profitability of the financial institutions. However, few researchers have explored the consequence on the banks' profitability in zero or negative interest rate environment.

Blot and Hubert (2016) found that the direct costs of negative interest rates are relatively small for financial institutions. Indeed, the total reserves held by European financial institutions at the ECB amounted to €777.4 billion composed of €117.8 billion of required reserves and €659.6 billion of excess reserves. In addition to these excess reserves, banks detain €387 billion in the ECB deposit facility. Considering the negative deposit rate, the annual gross costs incurred by the European banks amount to €4.2 billion. These costs are equivalent to 0.0132% of the total assets that are held by European banks, which amount to €31,700 billion. Jobst and Lin (2016) qualify the direct costs of negative interest rates. Indeed, banks in countries that are in a greater surplus of liquidity are more affected by the direct cost of negative interest rates in comparison to other European banks.

On the other hand, the indirect costs of the NIRP affect in a larger manner the profitability of banks. As mentioned earlier, the negative interest rates are transmitted to the interest rate channel by decreasing the rates applied on financial instruments across all maturities. Moreover, banks have been averse to setting negative deposit rates for their customers. Hence, the margin between the interest rates on loans and mortgages and on the deposit facilities has been squeezed. Claes et al. (2017) found that a decrease of one percentage point of the level of interest rates leads to a drop of 8 basis points of the net interest margin of financial institutions. In their findings, they also demonstrated that a prolonged low interest rate environment could have significant impact on the banks' profitability. These results reinforce the conclusions drawn by Demirgüç-Kunt and Huizinga (1999) and Genay and Podjasek (2014) that state that higher interest rates are resulting in higher profitability for banks.

Ball et al. (2016) found that the decreasing net interest margin is the consequence of the low neutral real interest rate environment. Hence, the negative interest rates do not directly impact the profitability of banks but contribute to the squeezed NIM, as long as the banks refuse to transmit the negative interest rates to their customers.

Nevertheless, the TLRO II programme has mitigated the negative effects of the contraction of the net interest margin. The programme, however, should have contrasting consequences on banks depending on the type of activities they undertake. While retail-based banks have more flexibility regarding the extension of the credit activities, the investment banks have less room for manoeuvre (Blot & Hubert, 2016).

In addition, the negative interest rates could increase the net interest margin of financial institutions in the beginning. Considering that the short-term rates are adjusting more quickly to a drop of level of interest rates than the long-term rates, financial institutions could generate a higher profit in the short term (Cœuré, 2016). Furthermore, as a consequence of better financing conditions for households and non-financial corporations, Demiralp et al. (2016) demonstrated that an increase by one percentage point in banks' excess liquidity results to a surge of 0.01 percentage point of loan emission.

Turk (2016) showed that the interest margin in Denmark has remained constant through the introduction of negative interest rates with a gap of 1.5% between deposit and lending rates. On the contrary, Swedish banks suffered a contraction of their interest rate margin due to the negative interest rates. However, the case of Swedish and Danish banks is special because of their reliance on wholesale funding such as money-market instruments and covered bonds in both domestic and foreign currency as a source of funding. These instruments, being also affected by the low interest rates, allow Scandinavian banks to mitigate the effects of negative interest rates on the interest margin.

Furthermore, extra costs are associated with negative interest rates. Firstly, the IT systems, which financial institutions use, have to be updated in order to integrate the negative interest rates (Sveriges Riskbank, 2016). This cost principally affects banks and FinTechs which are promoting the use of the blockchain. Indeed, the blockchain technology has not yet integrated the negative interest rates. Consequently, the NIRP is disrupting the whole system (Das, 2016). Secondly, a substantial portion of European banks still grant loans and mortgages with floating interest rates. Since the interest rates on loans went into the negative levels, these financial institutions have seen their margins on these instruments decrease and, in extreme cases, were

forced to pay interest on the loans they granted to their customers (Kowsmann & Neumann, 2015). Blot & Hubert (2016) analysed that 56.8% of loans granted to non-financial corporations and consumers in France were variable interest loans while it amounted to 32%, 77.2% and 82.3% in Germany, Spain and Italy respectively.

Moreover, a decrease in interest rates could result in a lower securities income in the longer-term. The interest rates adjusting to the new level of interest rates in the market, the income generated by the securities hold by a bank would experience a downward pressure (Jobst & Lin, 2016).

Chapter 4 Methodology

After assessing the origins of the negative interest rates, their effects through the different channels as well as the latest research on the profitability of the European banking industry and the impact of the negative interest rates on the profits of European banks, we will analyse the recent trends of the European bank business models in order to assess the impact of negative interest rates on these.

This research is innovative because, at the present time, analysts have been focusing on the impact of negative interest rates on the banking industry as a whole, without discriminating banks regarding the types of activity they perform. Therefore, we hope to add a perspective to the consequences of the introduction of negative interest rates by assessing if the profitability of distinct business models has been significantly impacted. This first hypothesis will also help us to determine if a certain business model has been advantaged or disadvantaged regarding the introduction of the NIRP.

Furthermore, on the one hand, following the first hypothesis, we will analyse the income sources in order to estimate if European banks have switched their sources of income with the aim of maintaining or enhancing their profitability in response to the NIRP. We will support the conclusion of this second hypothesis by examining the evolution of their total loans which is related to our third hypothesis. This hypothesis is linked to the incentive that gives the negative interest rates to banks to increase their total loan volume in order to mitigate the effects of negative interest rates as explain earlier. On the other hand, we will analyse the evolution of the equity of financial institutions to assess the impact of Basel III regulations on the banks' profitability.

In this second part, our analysis will be divided into two sections. First, we identify the different business models thanks to a clustering algorithm developed by Ward (1963) based on several descriptive variables. Then, we will analyse the descriptive variables in order to support the classification of banks in a defined cluster. Secondly, we will analyse the evolution of the profitability of the bank business models thanks to return on equity as well as the evolution of the sources of income the bank relied on in order to generate a profit. Next, we will perform statistical analysis with the aim of determining if the negative interest rates have impacted the profitability or the income sources of European banks. Furthermore, we will look at the trend in the different business models regarding the size of their loans' volume and the size of their equity.

4.1 Data

The data used is retrieved from the Bloomberg Terminal, a computer instrument collecting data of companies around the world updated by Bloomberg LP. The sample is composed of 25 banks located in the Eurozone and in the European Economic Area (EEA) such as Denmark and Sweden. The observations are retrieved on an annual basis. In total, the sample is composed of 200 bank-year observations and 34 variables (see Appendix 3) to describe each bank-year observation. The missing information has been completed by analysing the annual reports of these banks. The banks included in the sample analysed are presented in the Table 1.

These banks have been chosen because they are among the 50 largest banks inside the European Monetary Area (EMA). Indeed, they represent 56.23% of the total assets owned by the European banks (ECB, 2017b). Hence, we can analyse on a broader basis the impact of negative interest rates on the European banking industry. Moreover, it has been chosen to exclude financial institutions that had exceptional returns (positive or negative) such as Dexia Bank in order to have a better picture of the financial position of the European banks. Furthermore, banks with contradictory data between several information sources or with abnormal missing data were also not taken into consideration when building the bank sample.

The financial institutions are spread unevenly among the countries and differ greatly in size. Indeed, Germany detains the most bank in its territory with around 20% of the banks in the sample, while Danish and Belgian banks only represent 4% of the sample. The Swedish and Danish banks have been incorporated in the sample because the central banks of these countries have applied negative interest rates for the Sveriges Riskbank and further negative interest rates for the Danmarks Nationalbank in response to the low interest rates set by the ECB. Thus, the Danish and Swedish financial institutions are also impacted by the monetary policy developed by the ECB as their respective central banks are forced to lower their nominal interest rates in order to maintain a stable exchange rate between their domestic currency and the euro and a price stability (Turk, 2016).

Furthermore, the four French banks occupy ranks in the top ten as opposed to the Swedish financial institutions which are the most represented in the brackets between the 30th and 40th position according to the S&P Global Market Intelligence European Ranking (2016). The period covered range from 2009 till 2016 which will allow us to derive the performance of financial institutions after the crisis and before the negative interest rates and their profitability after the ECB set its deposit facility rate at negative levels.

Table 1: List of banks included in the sample analysed

Bank	Country	Total Assets (€ mil., 2016)
BNP Paribas	France	2,076,959.00
Deutsche Bank	Germany	1,590,546.00
Crédit Agricole SA	France	1,524,232.00
Société Générale	France	1,382,241.00
Banco Santander	Spain	1,339,125.00
Groupe BPCE	France	1,235,240.00
UniCredit	Italy	859,532.77
ING Group	Netherlands	845,081.00
Banco Bilbao Vizcaya Argentaria	Spain	731,854.00
Intesa Sanpaolo Group	Italy	725,100.00
Rabobank Group	Netherlands	662,335.00
Nordea Bank	Sweden	615,659.00
DZ Bank	Germany	509,447.00
Commerzbank Group	Germany	480,450.00
Danske Bank Group ⁱ	Denmark	468,553.62
ABN AMRO	Netherlands	394,482.00
KBC Group	Belgium	275,200.00
Svenska Handelsbanken ⁱⁱ	Sweden	274,371.90
Landesbank BadenWürttemberg	Germany	243,620.00
Skandinaviska Enskilda Banken	Sweden	273,647.86
Swedbank	Sweden	224,941.88
Banco de Sabadell SA	Spain	212,507.72
Bayerische Landesbank	Germany	212,150.00
Banco Popular Espanol SA	Spain	147,925.73
Unione di Banche Italiane SpA	Italy	112,383.92
<i>Total</i>		17,417,586.39

Notes: i: The spot exchange rate between the Danish krone and the euro was 0.1345 on the 30th of December 2016

ii: The spot exchange rate between the Swedish krona and the euro was 0.10442 on the 30th of December 2016

Source: Bloomberg

4.2 Ward's Algorithm

Following the works of Roengpitya et al. (2014), Ayadi et al. (2011), Ayadi et al. (2014) and Ayadi et al. (2016) we use a statistical classification algorithm developed by Ward (1963)

in order to classify banks into different business models. To do so, we will rely on five variables that describe each observation. In theory, banks having the same business model should, consequently, have the same figures concerning their attributes/variables. The Ward's algorithm is a feature based algorithm as opposed to a similarity based one (Saerens & Decaestecker, 2017). Furthermore, it has to be pointed out that this method is a hierarchal algorithm. Hence, the observations belong to a cluster or they don't, it refers to a 1/0 relationship or a crisp membership (Saerens & Decaestecker, 2017).

The Ward's method has been used widely for clustering partitions of quantitative data because of its simplicity and it works well with large datasets (Murtagh & Legendre, 2014)

The Ward's method relies on the optimisation of an objective function while clustering observations. As the clustering algorithm groups together single observations, information is lost down the road. Indeed, the greatest information appears when the sample is composed of n clusters containing each a single observation. Therefore, the algorithm forms clusters in a way that the loss of information is minimal. The loss of information is the linkage criterion and is represented by the total sum-of-squared-errors within a cluster (I_k) or the so-called total inertia within clusters (I_W). As clusters are being formed, the total inertia of the sample remains constant (I_T) and the inertia within the cluster has to be minimal and the inertia between the clusters (I_B) must be the highest possible (Saerens & Decaestecker, 2017).

$$I_T = I_W + I_B$$

$$I_B = \sum_{k=1}^K |G_k| d^2(g_k, g) \quad k = 1, \dots, K$$

$$I_W = \sum_{k=1}^K I_k = \sum_{k=1}^K \sum_{i \in G_k} \|x_i - g_k\|^2 \quad k = 1, \dots, K; i = 1, \dots, n$$

$$I_k = \sum_{i \in G_k} d^2(x_i, g_k) = \sum_{i \in G_k} \|x_i - g_k\|^2 \quad k = 1, \dots, K; i = 1, \dots, n$$

$$g_k = \frac{1}{|G_k|} \sum_{i \in G_k} x_i \quad k = 1, \dots, K; i = 1, \dots, n$$

G_k , $|G_k|$, x_i and g_k represent the group/cluster k , the number of observations in group k , the i^{th} individual in group k and the centre of gravity of the group k respectively.

The metric used for the distance between the observations in the sample is the squared Euclidean distance, which is as follows:

$$d^2(x, y) = \sum_{i=1}^n (x_i - y_i)^2 \quad i = 1, \dots, n$$

The squared Euclidean distance is the most common metric to measure the distance between observations. Furthermore, Miyamoto et al. (2015) are claiming that the Ward's algorithm has been designed to be used with the squared Euclidean distances. However, it is subject to criticism regarding the weight it assigns to outliers (Saerens & Decaestecker, 2017).

The Ward's algorithm is an agglomerative clustering program. We can visually represent the sample as a tree or a dendrogram. The algorithm starts with the leaves of the tree, which amount to n clusters of size one. Then, it searches to group the two closest observations to reduce the sample to $n-1$ clusters. Next, the newly created group is analysed in order to determine if we should add another observation to the cluster or a new cluster has to be formed with the aim of optimising the loss of information. The algorithm goes on grouping leaves together to form branches. Finally, it gathers the branches together to build the trunk of the tree. At this stage, all observations are in the same cluster of size n (Ward, 1963).

4.2.1 Set of Variables

In order to use the classification algorithm, we must specify a set of variable that will define the observations. Roengpitya et al. (2014) identify three key variables that are the most representative in order to group financial institutions into different clusters: the gross loans, the interbanking lending and the wholesale debt. In addition to these variables, we will use two additional variables, based on the work of Ayadi et al. (2016), in order to further distinguish the banks regarding their business model: the trading assets and the leverage ratio or the equity-to-asset ratio. Each variable is expressed as a percentage of the financial institution's total assets. The variables are taken from the balance sheet of the banks rather than the income statement because the incomes and charges of a bank reflect the consequences of the management choices, i.e. the business model. Thus, it is more appropriate to look at the balance sheet characteristics of a bank to determine its business model (Roengpitya et al., 2014).

- a. Gross loans (as % of total assets): This variable represents the amount of total loans a bank lends to customers in regards to its total assets. A higher percentage means that the financial institution is engaging itself in more traditional activities. The loans can be given to non-financial corporations as well as financial institutions (Moody's, 2011).
- b. Interbank lending (as % of total assets): The interbank lending allows us to visualise the presence of a financial institution on the interbank market. A higher percentage is

representative of banks having a business model close to wholesale banking or investment banking (Roengpytia et al., 2014). It is represented in the annual reports of financial institutions as the loans and advances to banks.

- c. Wholesale debt (as % of total assets): Also known as wholesale funding, the wholesale debt refers to funds acquired from banks, governmental institutions and large non-financial institutions. Although it can be used for retail banks as a substitute for traditional deposit funding, it is the main source of funding of wholesale banks (Huang & Ratnovski, 2011). It is calculated as the sum of long-term debts, short-term debt and repo operations (Roengpytia et al., 2014).
- d. Trading assets (as % of total assets): The trading assets represent the portion of assets that are held by a bank with the intent to sell them on a short basis. Banks with a business model close to an investment bank will have a high volume of trading assets in regards to its total assets. The total trading assets are computed as the total assets minus the gross loans, the cash and deposits and the intangible assets (Roengpitya et al., 2014).
- e. Equity-to-asset (as % of total assets): The equity-to-asset ratio is an indicator of the funding strategy of the financial institution. A bank with a larger equity-to-asset ratio will prefer to finance its assets by seeking fund towards shareholders rather than creditors. Moreover, the higher the equity ratio, the higher the soundness of the financial institution (Michigan State University, 2011).

4.3 Calinski & Harabasz's (1974) Pseudo-F Index

In order to decide where to stop the algorithm to form clusters, we will base our decision on the pseudo-F index designed by Calinski and Harabasz (1974).

The pseudo-F index measures the ratio of inertia between clusters to the inertia within clusters during the clustering operation. (Calinski & Harabasz, 1974):

$$Pseudo-F\ index = \frac{I_B/(K-1)}{I_W/(N-K)}$$

I_B , I_W , N and K are, respectively, the inertia between the clusters, the inertia within the clusters, the number of observations in the sample, and the number of clusters at any stage

during the hierarchical clustering. The larger the values of the pseudo-f index are, the best the sample is grouped in clusters that have low within inertia and high between inertia. In other words, the higher the Calinski and Harabasz index, the better the clustering. This index has been chosen due to its great compatibility with the algorithm developed by Ward (Wilkinson et al., 2000).

4.4 Limitations of the Clustering Algorithm

It must be pointed out that clustering is an ill-posed problem because it relies on the point of view of the analyst to decide where to stop the clustering/the aggregation of clusters. Hence, it is not an exact science and is more closely related to an art (Saerens & Decaestecker, 2017).

Furthermore, the assignment of a bank-year observation into an individual cluster is closely related to the choice of the clustering algorithm, the distance metric to represent the distance between the observations as well as the choice and the number of the variables used to describe the sample. Indeed, as we add or withdraw describing variables, the outcomes of the classification would differ by a large amount (Ayadi et al., 2011). Therefore, we recommend using a critical and careful approach when examining the results of this study. However, the number and the nature of the variables were chosen in accordance with the studies already performed on the subject which reduces the probabilities of misclassification. Indeed, the results generated by the Ward's algorithm are consistent with the expectations and clearly represent business models that are in use during the period surveyed (Ayadi et al., 2011).

4.5 Statistical Tests of the Hypotheses

In order to evaluate the impact of the negative interest rate on the performance of the different business models, we will use several performance indicators and compare their evolution throughout the period analysed (2009 to 2016). The core hypothesis of this master thesis is that the introduction of negative interest rates has affected the profitability of financial institutions. We should observe the impact by a significant change in the return on equity or the return on assets of banks since 2014, which represents the date when the ECB set its deposit rate at the negative levels. The magnitude of the change would depend on the business model of the bank.

4.5.1 T-test

First, we divide each cluster formed between two groups: the pre-negative interest rates policy and the post-negative interest rate policy⁶.

Then, we perform a T-test to test the hypothesis that the mean returns on equity from the two groups formed inside a cluster are significantly different. A paired-samples T-test is useful when we compare the means of a sample over specific periods. However, the two groups compared have to be the same size and of the same nature. It has to be a one-to-one relationship. Therefore, if a bank changes from one cluster to another, the pair is broken and the size of the two groups analysed is different.

Hence, we use an independent T-test to compare the two groups. The independence between the two groups is a strong assumption but can be justified by the non-significant correlation between these groups. The independent-samples T-test formula and the hypothesis are as follows:

$$H_0: \overline{ROE}_{pre_k} = \overline{ROE}_{post_k} \quad k= 1, \dots, n$$

$$H_1: \overline{ROE}_{pre_k} \neq \overline{ROE}_{post_k} \quad k= 1, \dots, n$$

$$t = \frac{\overline{ROE}_{pre_k} - \overline{ROE}_{post_k}}{s_p \sqrt{2/n}}$$

$$s_p = \frac{\sqrt{s_{ROE_{pre_k}}^2 + s_{ROE_{post_k}}^2}}{2}$$

Where s_p is the pooled standard deviation of the two groups.

The null hypothesis is rejected if the p-value of the test is higher than 0.05, which corresponds to a significant change in the ROE of the financial institutions present in the cluster.

The same test will be executed on the interest income, the fees and commissions' income, the trading income, the other operating income in order to verify our secondary hypothesis. Indeed, we want to assess the evolution of the different source of income with the aim of determining if the business models have changed the size of the sources of income relative to the total operating income in order to maintain or enhance their return on equity or mitigate the

⁶ The pre and post refer to the introduction date of the negative interest rates i.e. 2014

negative effects of the negative interest rates on their return on equity. Furthermore, we will test the evolution of the total common-sized loans and the common-sized total equity. If the total loans to customers have significantly increased, the negative interest rates had the expected result of easing the credit conditions for consumers and mitigate the negative effects on the interest income described earlier.

The variables of the sampled banks have been normalised in order to perform the independent T-test when the distribution was too skewed. Indeed, the T-test can only be performed on near normal distribution.

The formula used for the normalisation is as follows:

$$\frac{X - \bar{X}}{s}$$

Where X , $\bar{X}$ and s are the value of an observation for the variable, the mean value of all observation for the variable and the standard deviation for the variable respectively.

Chapter 5 Empirical Results

5.1 Three Main Business Models

After running the Ward's algorithm, we find that the sample can be divided in three different groups based on the Calinski & Harabasz pseudo F-index (see Appendix 4a). The results of the algorithm are in line with the findings of Roengpitya et al. (2014) and Ayadi et al. (2011) that show we can distinguish banks in three different types of business model. The three clusters and their characteristics are summarised in the Table 2.

Table 2: Business models' descriptive variables (divided by banks' total assets)

	Obs.		Gross loans	Trading assets	Wholesale debt	Interbank lending	Equity ratio
Retail banks	75	Mean	0.6823	0.2646	0.4062	0.0495	0.0613
		Std. Dev.	0.0530	0.0522	0.0965	0.0253	0.0153
		Min.	0.5864	0.1313	0.2183	0.0119	0.0232
		Max.	0.8179	0.3535	0.6134	0.1515	0.1010
Investment banks	66	Mean	0.3531	0.6139	0.3165	0.1080	0.0432
		Std. Dev.	0.1027	0.1042	0.1051	0.0954	0.0114
		Min.	0.1742	0.4174	0.1483	0.0016	0.0253
		Max.	0.5342	0.8128	0.5343	0.3971	0.0680
Wholesale banks	59	Mean	0.5313	0.4328	0.4417	0.0851	0.0521
		Std. Dev.	0.0520	0.0578	0.0940	0.0519	0.0131
		Min.	0.3635	0.3537	0.2908	0.0147	0.0256
		Max.	0.6352	0.6305	0.6846	0.2202	0.0829
<i>Total</i>	200	Mean	0.5291	0.4295	0.3871	0.0793	0.0526
		Std. Dev.	0.1562	0.1645	0.1110	0.0679	0.0154
		Min.	0.1742	0.1313	0.1483	0.0016	0.0232
		Max.	0.8179	0.8128	0.6846	0.3971	0.1010

Notes: The variables are expressed in percentage of total assets of the financial institution

Source: Bloomberg; author's calculations

The first group is related to banks with a business model which is focused on the term structure transformation. According, to the selected variables, we can categorise this cluster as banks following a retail focused business model. Indeed, the gross loans represent on average 68.23% of the total assets owned by these financial institutions. Furthermore, it can be clearly seen that in comparison with the two other business models, the share of trading assets regarding the total assets is smaller. In addition, this business model is seeking more funds on the equity

market. Hence, the cost of funding should, *ceteris paribus*, be larger for these banks than their competitors with a different business model. Finally, it is the most populated cluster with 75 bank-year observations throughout the 2009-2016 period.

Secondly, the second cluster can be described as banks that follow a business model which is oriented towards trading activities. The trading assets hold a 61.39% share of the total assets detained by these banks with a maximum value of 81.28%. Moreover, the gross loans percentage in regards to the total assets is significantly lower than the other business models with just over a third. According to the algorithm, the investment banks are the largest lender to banks and other financial institutions. This result is consistent with the analysis of Roengpitya et al. (2014) which states that investment banks are active on the interbank market. In addition, this business model is the riskiest in regards to the leverage ratio.

Finally, the last business model is the wholesale banking which contains only 59 observations out of the 200 bank-year observations. This result is consistent with the analysis of Kok et al. (2016) concerning the recent trends in the business models of financial institutions. These banks are focused on granting loans to large corporations and banks as well as receiving funds from the same type of institutions. Indeed, the wholesale debt is representing nearly half of the total assets owned by this type of bank with a maximum of 68.46% while the customer loans (or gross loans) are more than half of the total assets.

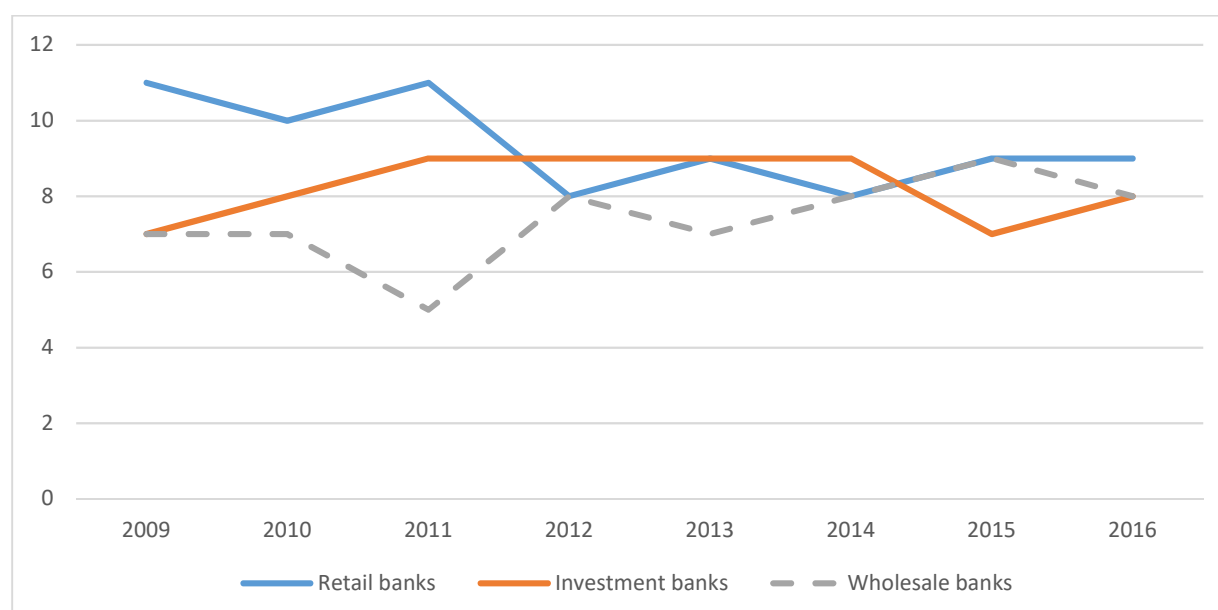
In addition to the variables used to distinguish the different business model, the size of the banks is a pertinent criterion to classify a bank. Indeed, larger banks have been more inclined to pursue trading activities while smaller banks are more retail focused providing loans to retail customers and funding themselves with deposit accounts of these same customers (Ayadi et al., 2016). These assumptions are consistent with our clusters as the retail cluster is composed of small banks with a mean total asset value of €451,670 million while the group composed of investment banks has, on average, a balance sheet amounting to €1,071,060 million (see Appendix 8a). Furthermore, the retail group is relying the most on customers' deposits with a mean value of 44.10% of the total assets followed by the wholesale banks and investment banks with 33.27% and 32.37% respectively (see Appendix 8c).

5.2 Evolution of the Business Models

The size of the business models is fairly stable throughout the period analysed. Indeed, the number of banks constituting a cluster remains quasi-constant from 2009 to 2016 (see Fig. 4). This finding is in contradiction with the study of Kok et al. (2016) which states that the banking industry has been shifting from the wholesale business model towards the retail oriented business model. However, as mentioned earlier, the number of wholesale banks is lower than the two other business models. Furthermore, the number of banks following a retail oriented business model reached 9 for the banks in 2016, which represents the largest cluster for this year. This observation is consistent with the findings of Roegpitya et al. (2014).

In addition to the size of the clusters, the banks kept in most cases the same business model throughout the period analysed with the exception of six banks. Two banks, the Landesbank BadenWürttemberg and the Commerzbank, switched their business model to an investment bank model. However, the Landesbank BadenWürttemberg returned to its wholesale oriented business model. ING changed its trading oriented business model in favour of a more retail focused one in 2015. BBVA adopted a wholesale business model in 2012. Finally, Intesa Sanpaolo and UniCredit changed back and forth between the retail and the wholesale business model during 2009 and 2016.

Figure 4: Yearly evolution of the number of banks attributed to a business model (2009-2016)



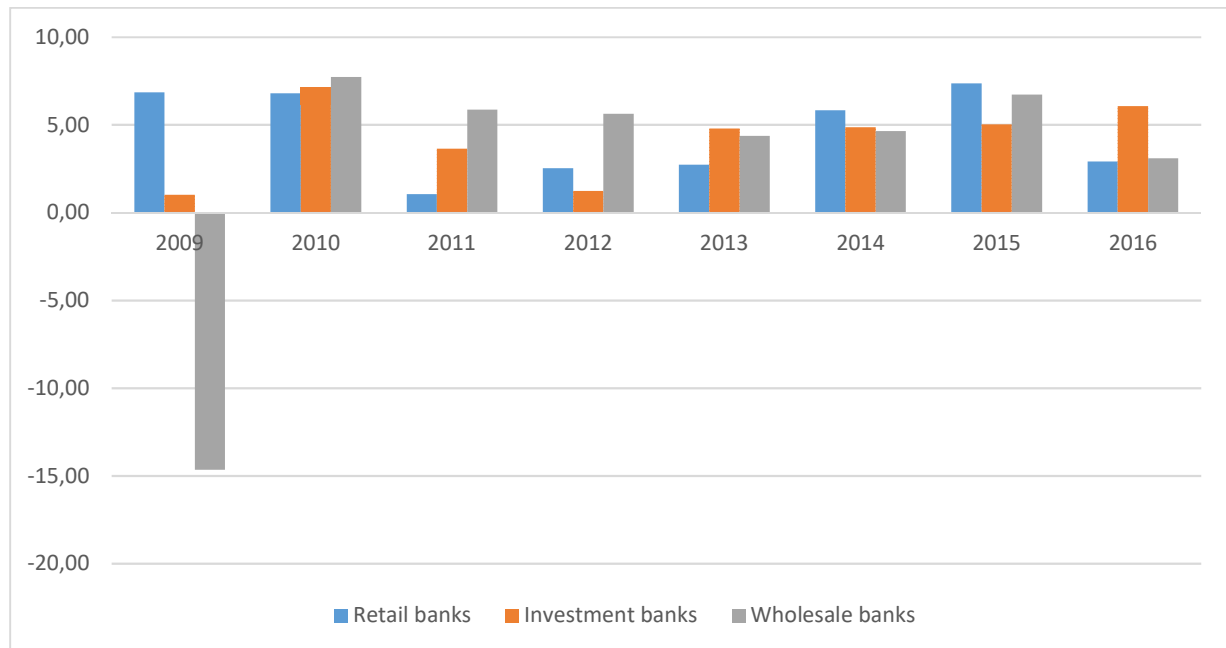
Source: Bloomberg; author's calculations

5.3 Return on Equity Analysis

The return on equity of the banking industry has been dramatically impacted by the financial crisis of 2008. Indeed, prior to the crisis, the return on equity of financial institutions was oscillating around the 15% level (ECB, 2016c). The wholesale banks have suffered the most compared to the banks using other business models (see Fig. 5). The loss is attributed to a large extent to the trading activities undergone by these banks (Ayadi et al., 2016).

Nevertheless, following the crisis, wholesale banks have turned tables and generated the largest returns on equity three years in a row from 2010 till 2012. In 2016, investment banks have taken the lead in terms of return of equity.

Figure 5: *Business models' yearly return on equity (in %, 2009-2016)*



Source: Bloomberg; author's calculations

The retail banks have been the most prolific regarding the period analysed with a mean return of equity of 4.505% followed by the investment banks and the wholesale banks with 4.219% and 2.922% respectively (see Appendix 8d). It can be easily seen on the graph that the year 2009 has a strong impact on the average profitability of the wholesale banks. Therefore, as we exclude this year from the sample, the wholesale banks outperform both other business models.

This phenomenon could be explained because of the lower equity ratio that these banks have. The wholesale cluster is composed in majority of Danish and Swedish banks such as the Nordea Bank, the Danske Bank and Skandinaviska Enskilda Banken. These banks have been able to fund themselves on the wholesale market which adjusted the rate applied on its instruments, giving the opportunity to these banks to mitigate the negative effects of the negative interest rates.

In addition to the crisis, the new set of reforms established by the Basel Committee on Banking Supervision has undermined the return of equity across the banking industry. Indeed, the higher capital ratio decreased the opportunity for financial institutions to boost their return on equity. However, it ensured a sound and stable banking industry. Consequently, it could influence positively the returns of banks in the future because of the lower probability of a global crisis occurring (Elliot et al., 2012).

As it could have been expected from the graph, the return on equity of the European financial institutions has not been significantly changed after the introduction of the negative interest rates, whatever the bank business model (see Table 3). Therefore, we could conclude that the negative interest rates have not been affecting either positively or negatively the returns of European banks two years after their introduction in Europe on average.

These results are in contradiction with the analyses of the financial world actors. Indeed, according to a report from Standard & Poor's, the negative interest rates are impacting negatively the profits of the banking industry (Dunkley, 2016a). Furthermore, we can observe on the graph that the return on equity of retail banks and wholesale banks have decreased in 2016 which is consistent with the expectations that the negative interest rate policy is squeezing the net interest margin. Consequently, it affects the return on equity of these kinds of banks. It is important to point out that it is the first negative evolution for the retail banks since 2011 and the lowest return on equity for the wholesale banks. However, although retail banks had a lower return on equity in 2016, it is important to indicate that Banco Popular Espagnol had an extremely low ROE in 2016 (-29.57%) which could drag down the overall return on equity of retail banks in 2016.

On the contrary, investment banks have been steadily performing better since 2012 with the highest return on equity in 2016. These two observations could reinforce the analysis of Ball et al. (2016) that the negative interest rates are promoting financial institutions that generate larger

fee and commission income such as investment banks as the European banks are still refusing to pass on the negative interest rates to their customers.

Table 3: *Independent T-test of business models' pre-and post NIRP means return on equity*

	t	p-value (2 tail.)	df	Mean difference	Std. Error difference	Lower bound (95% CI)	Upper bound (95% CI)
Retail banks	-0.058	0.954	71	-0.13445	2.31746	-4.75532	4.48643
Investment banks	-0.621	0.537	63	-1.02866	1.65676	-4.33942	2.28211
Wholesale banks	-0.734	0.466	55	-2.08117	2.83617	-7.76498	3.60264

Notes: in order to reject the null hypothesis, the p-value must be lower than 0.05

Sources: Bloomberg; author's calculations

Nevertheless, we can notice that the return on equity has been enhanced after the introduction of the negative interest rates as the mean difference for each business model is negative, meaning that the average return on equity from 2009 to 2013 is lower than the return on equity for the period between 2014 and 2016.

We could explain the positive performance throughout the period analysed because the European banks are slowly recovering from the great financial crisis. Therefore, it is normal that these same banks have been performing better for the last years than directly following the financial crisis. Furthermore, financial institutions could have engaged themselves in deleveraging operations in order to shrink their equity to boost their return on equity.

However, financial regulators can explain this performance because of the negative interest rate policy which boost the returns of the banking industry by creating an environment where the credit conditions are eased. Hence, the financial institutions could increase their loan volume in order to mitigate the negative impact of the squeezed interest margin. Moreover, as stated by Cœuré (2016), the net interest margin on the short term are expanded. In addition, the negative interest rates engender that a part of bad loans are now creditworthy due to the eased financial conditions.

Furthermore, the European financial institutions could have focused their activities on a specific source of income after the introduction of the negative interest rates to generate a higher profit such as the increase of fees and commissions or the trading activities.

These assumptions are related to our second hypothesis that states that negative interest rates have modified the repartition of the different sources of income in regards to the total operating income.

Nonetheless, it is important to emphasise that we should still take into consideration the lower return on equity from 2016 of the wholesale and retail banks in comparison to those of the two previous years.

In order to assess our second hypothesis, we will look at the proportion of the different sources of income compared to the total operating income of the financial institutions. An increase in the net interest income would validate the theory of financial regulators concerning the performance of banks. On the other hand, a significant expansion of another type of income would be consistent with the expectations of banks changing their focus on the non-interest income to maintain their profitability.

5.4 Retail Banks

5.4.1 Sources of Income Evolution

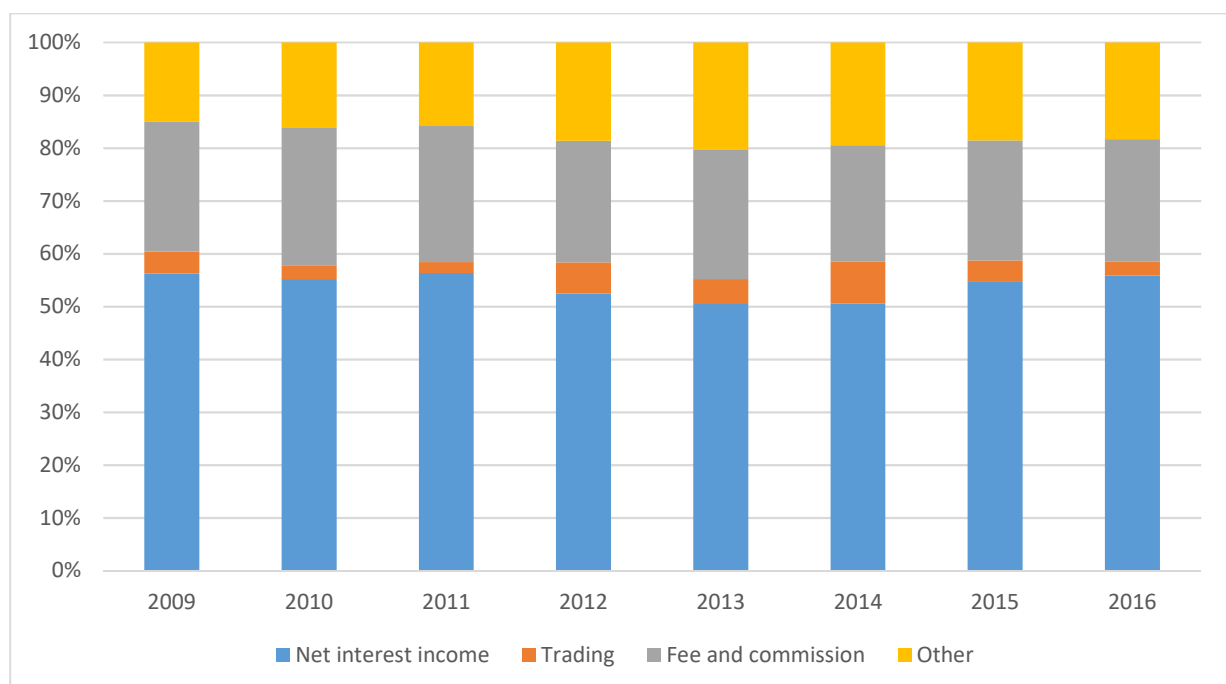
The different sources of income have remained stable for the European retail banks throughout the period analysed. Indeed, each source of income has not significantly changed since the introduction of the negative interest rates. This result shows that retail banks have kept their focus on the term transformation without switching towards the non-interest income. One might argue this outcome is due to the conditions set by the governments in order to receive a state aid following the financial crisis. Indeed, European countries injected capital in distressed banks only providing that these banks would refocus their business activities on the traditional retail activities (European Commission, 2010).

The retail banks are unsurprisingly generating a large part of their total income by the term transformation. Indeed, each year, the net interest income is the largest component of the total income generated by this cluster. However, we can notice that the portion of the net interest income is decreasing since 2011. Nonetheless, there is an increase in 2015 and 2016. As expected, the trading income of retail banks is significantly lower than the other types of income, especially directly following the financial crisis. Retail banks have slightly increased their fees & commissions income in 2014 (see Fig. 6).

As Cœuré (2016) stated, negative interest rates could benefit financial institutions which are retail focused because the short-term rates are adjusting more quickly than the longer-term rates. Therefore, on the short-term, banks would generate a higher profit with the introduction of negative interest rates. Hence, it explains the better performance in 2014 and 2015. ABN AMRO represents perfectly this situation as its: “*underlying net profit for FY 2014 double compared with FY 2013*” (ABN AMRO Bank N.V., 2015, para. 1) and: “*the FY 2015 underlying net profit increased to EUR 1,924 million, up 24% compared with FY 2014*” (ABN AMRO Bank N.V., 2016, para. 1).

However, as the loans are coming to maturity and the long-term interest rates are adjusting to the low interest rates environment with the zero lower bound constraint on deposits, the net interest margin is affected. In addition, the rates on variable rate loans are adjusting to the low interest rate environment, forcing banks to pay their borrower in extreme cases. Indeed, despite the 4% rise due to its Brazilian activities, Banco Santander recorded a decrease of 3.4% in its net interest income of 2016 in comparison with the net interest income generated in 2015 (Aguado & Berwick, 2017). Hence, the lower performance of these financial institutions in 2016.

Figure 6: Evolution of the retail banks’ sources of income (% of total operating income, 2009-2016)



Source: Bloomberg; author's calculations

5.4.2 Total Loans Evolution

Due to the eased credit conditions created by the negative interest rates, retail banks have increased their common-sized total loan volume by nearly 2 percentage points in 2015 and a further increase of one percentage point in 2016 (see Appendix 9d). Indeed, thanks to the TLTRO, retail banks have received funds with low cost of opportunity that they transformed into loans. In turn, the loan expansion allowed retail banks to maintain their profitability. Indeed, ING expanded its common-sized total loans by 7 percentage point from 2014 to 2016. Nevertheless, this growth is not sufficient in order to prevent the compression of the net interest margin (see Appendix 12). Furthermore, according to Jobst and Lin (2016) the situation won't improve in the future. Indeed, the loan demand is not going to soar up due to the decreasing consumer confidence in the economy and the increased risk aversion which prevent investor to borrow money to invest in projects. Hence, we could deduce from these observations that, as recommended by Ullersma (2002), the cornerstone of the economic recovery resides in the confidence of the consumers that has to be regained and nurtured.

5.5 Investment Banks

5.5.1 Sources of Income Evolution

Following the financial crisis, investment banks have dramatically reduced their trading activities which is translated to a very low trading income in comparison to the total operating income. However, the trading income is slowly growing since 2011 but remains low due to the restrictions cited earlier concerning the trading activities. Indeed, trading activities require a larger capitalisation to reflect the risk associated with these activities and shield the bank against it.

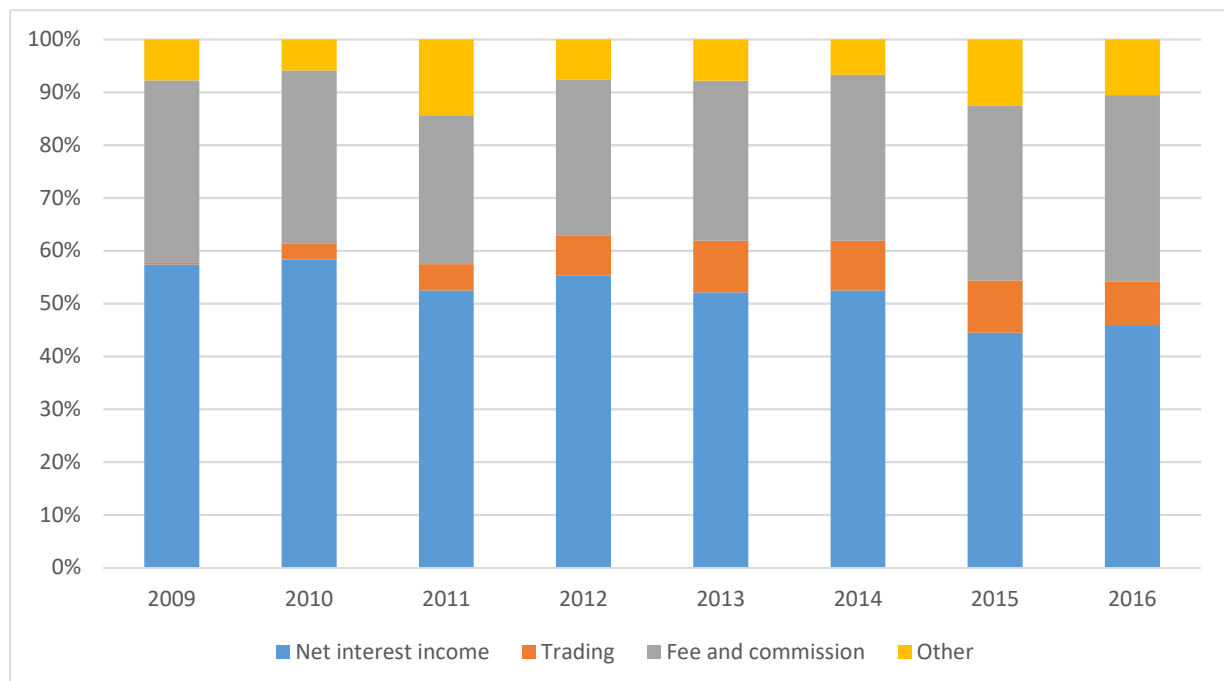
As we can see on the graph (Fig. 7), since 2014, investment banks have generated a higher ratio of net fee and commission income in regards to the total income than prior to the introduction of the negative interest rates. In 2016, the net fee and commission income share of total operating income was the same as in 2009. The higher net fee and commission income has taken the place of the interest income which has decreased proportionally. However, it has to be pointed out that the levels of the net fee and commission income in regards to the total operating income before and after the introduction of the negative interest rates are not significantly statistically different (see Appendix 10b).

Furthermore, the total non-interest income represents more than 50% of the total operating income of the investment banks after the establishment of the negative interest rate policy.

These results are consistent with the interest channel theory. Due to negative interest rates affecting interest rates across all maturities, price of financial instruments is soaring up. Consequently, as mentioned earlier by a study by the CFA (2013), the fees and commissions on the management of the customers' assets are increasing as well. Hence, we observe a greater part of the net fee and commission income in regards to the total operating income. As opposed to this surge, the net interest income is slowly decreasing as the longer-term interest rates are adjusting to the low level of interest rates. Hence, the investment banks are turning voluntary or involuntary their business model towards more fee and commission income in order to maintain and, even, enhance their profitability.

Indeed, Société Générale, which is clustered in investment banks (see Appendix 6), has generated a net income of €1.1 billion in the third quarter of 2016 with an increase in the profits of the investment activities (see section III.1.2 and III.3.1) of more than 42% while the net interest income fell by 15.1% (Thompson, 2016).

Figure 7: *Evolution of the investment banks' sources of income (% of total operating income, 2009-2016)*



Source: Bloomberg; author's calculations

Therefore, we can deduce that the negative interest rates have positively impacted the income generation of investment banks by “artificially” increasing the asset prices, giving to these banks the opportunity to generate higher net fee and commission income.

5.5.2 Total Loans Evolution

In accordance with the decrease in the net interest income of 2015, the total loans of financial institutions have also been compressed since the introduction of the negative interest rates. Indeed, the common-sized total loans of investment banks plummeted by more than 2 percentage point following 2014. Nonetheless, last year, it reached its pre-negative interest rates level which is translated in a slightly better net interest income (see Appendix 10d). However, the net interest income is still a minority share of the total operating income due to the flattened yield curve and the difficulty for investment banks to increase their total loan volume in order to mitigate the effects of negative interest rates as the confidence of corporations is not yet restored (Jobst & Lin, 2016). Indeed, Jean-Laurent Bonnafé, the CEO of BNP Paribas, stated that the term transformation is declining due to the tough economic environment and as its bank common-sized total loans were decreasing from 2015 to 2016 (Nikolaeva & Ponthus, 2016; BNP, 2017).

5.6 Wholesale Banks

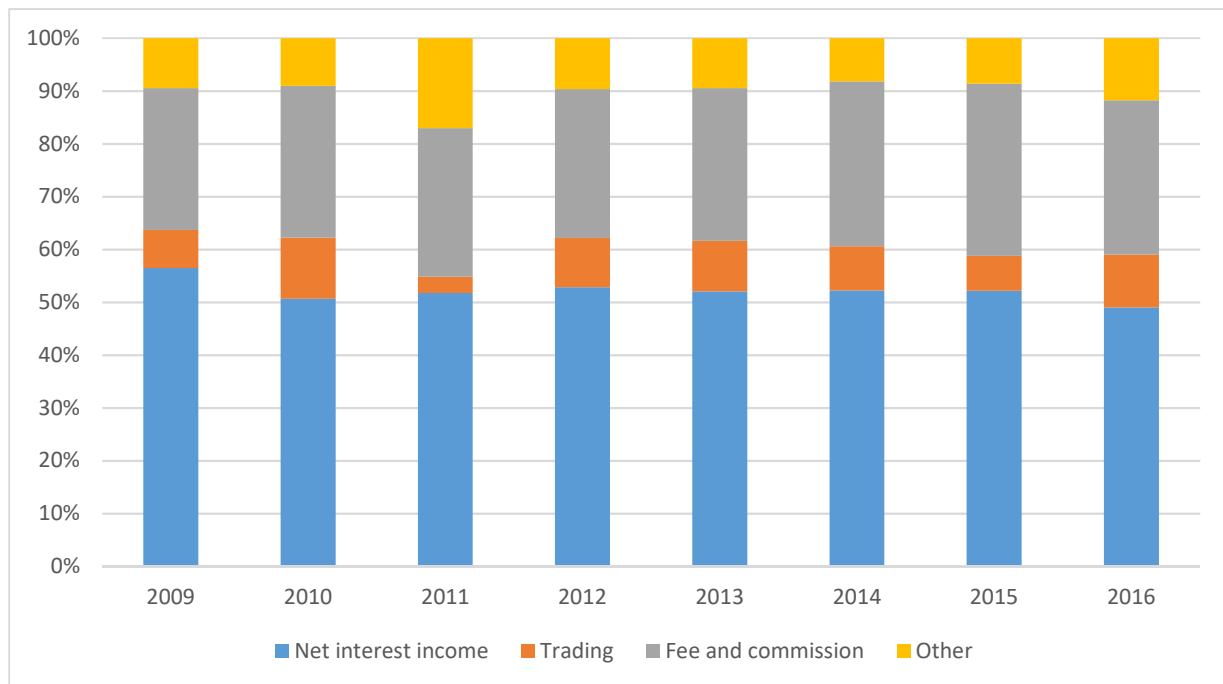
5.6.1 Sources of Income Evolution

Wholesale banks have the same profile of sources of income as the retail banks. Indeed, as we can see on the graph, the average net interest income regarding the total operating income is equal to 52.17%. The sources of income have not significantly changed since the introduction of negative interest rates which indicates that wholesale banks have not switched their focus on the non-interest income. However, we can observe that the net interest income is slowly decreasing since 2014. In addition, while the net fee and commission income was fairly stable throughout the period analysed, oscillating around 28% of the total operating income, it has increased by more than 4% in 2015 reaching 32.6% of the total operating income of wholesale banks.

This increase can be attributed, as for the investment banks, to the negative interest rates increasing the value of assets through the interest rate channel. Hence, the net fee and

commission income is increasing as well. Furthermore, it has not increasing enough to conclude that wholesale banks have increased their fees and commissions in response to the negative interest rates.

Figure 8: Evolution of the wholesale banks' sources of income (% of total operating income, 2009-2016)



Source: Bloomberg; author's calculations

In addition, 2016 is the first year that the non-interest income is superior to the net interest income of wholesale banks. It is a crucial information that could show that the net interest income is deeply under pressure due to the environment of low level of interest rates. Furthermore, it could point out that the financial institutions are less relying on wholesale funding despite the lower opportunity cost.

Indeed, Nordea Bank has suffered a reduction of 5% of its net interest income in 2016 which translated to a decrease of 12.3% of its return on equity in comparison with 2015 (Nordea Bank AB, 2017b)

5.6.2 Total Loans Evolution

Since the introduction of the negative interest rates, the total loans of wholesale banks have been depressed because financial institutions have turned towards funding from central banks. Indeed, the common-sized total loans decreased by 2 percentage points in 2014 and remained stable afterwards (see Appendix 11d). As Jobst and Lin (2016) stated the economic agents, and more specifically corporations, are averse to borrowing money in order to make investments. Therefore, wholesale banks cannot extend their loan volume due to the decreased demand of the credit market. Moreover, the same effect as for the investment banks applies on the wholesale banks. Indeed, financial institutions are less reliant on wholesale funding in loose monetary policies (Choi & Choi, 2016). As the ECB is pouring large amounts of cost-free liquidity through its targeted longer-term operations, the financial institutions are not looking for liquidity in the wholesale market. It is clearly illustrated by the total loans of Nordea Bank which decreased by 7% from 2015 to 2016 (Nordea Bank AB, 2017b).

5.7 Equity and Costs Evolutions

Throughout the period analysed, each business model has increased its equity size (see Appendices 9e, 10e, 11e). We could interpret this decision as a consequence of the new set of reforms designed by the Basel Committee in order to enhance the soundness of financial institutions across the globe. Indeed, as mentioned in Section III.2.1, the Basel III accords compel financial institutions to increase their Common Equity Tier 1 volume as it represents the highest quality of funding a bank can borrow in order to sustain economic shocks and financial stresses.

However, the expansion of banks' equity obviously bears consequences as it diminishes the return on equity of financial institutions. Moreover, the equity has an "infinite" maturity and bears no seniority for reimbursement. Hence, the cost of funding is significantly higher than the wholesale funding and the customer deposits. Consequently, it increases the cost of funding across the banking industry. Nonetheless, as it was mentioned earlier, the gains from this new set of reforms in terms of financial stability are largely overtaking its downsides.

Furthermore, we can observe the paradoxical effect of the negative interest rates. On the one hand, the ECB is encouraging financial institutions to invest in riskier assets and grant loans to riskier borrowers with the aim of launching the economic recovery. On the other hand, the banking regulators and supervisors compel banks to decrease their riskier activities and expand

their equity to enhance their financial soundness. Therefore, as banks are increasing their loan volume, they also need to raise more capital to back these new loans as their Risk Weighted Assets have increased as well. Consequently, the return on equity of lending institutions is impacted.

In addition to the extension of the equity, financial institutions have launched actions to reduce drastically their operating costs in order to boost their return on equity as it is advised by Cœuré (2016, para. 47) in his speech at the Yale Financial Crisis Forum: “... *banks should adapt continually to the changing environment by adjusting their business models, cutting their operating costs and reducing their non-performing loans.*”

The most common thought is to reduce the workforce of a company. Indeed, most financial institutions have performed restructuring plans in order to cope with the lower profitability and the high cost-to-income ratio. First of all, for the past years, financial institutions have cut a significant number of branches and jobs that got along with them. The most recent examples are the mass layoffs from ING and Deutsche Bank with, at the time of the announcement, around 7,000 and 10,000 job cuts worldwide respectively (Brunsden, 2016; Morris et al., 2017). A fortiori, Wendel (2011) recommended to the retail and business banks to create a ranking of the payroll and immediately sack the 5% that constitute the bottom of the ladder.

In the first stages of the restructuring, banks are facing large costs that encumber the bottom line of these institutions. Indeed, in the ING case, the Dutch bank has set aside a provision of €1.1 billion in order to complete its restructuring plan (ING, 2017b). Hence, the worse financial results for 2016 could be in part explained from these massive restructuring plans undergone by banks.

Chapter 6 Discussions and Limitations

6.1 Towards Riskier Banks?

Our analysis demonstrated that the European banks' average return on equity following the introduction of the negative interest rates hasn't significantly changed in comparison with the mean return on equity after the crisis. However, our analysis didn't go through the assessment of the risk of the different financial institutions. Furthermore, as mentioned earlier, the profitability of retail and wholesale banks has been undermined last year. Hence, these financial institutions could, in response to these lower profits, decide to invest in riskier assets with the aim of generating a higher income.

Indeed, one of the channels that transmits the negative interest rate policy is the portfolio balance and risk taking channel. Through this channel, financial institutions are encouraged to switch from safer assets towards riskier assets to lift their return on equity as a large number of sovereign bonds holds nowadays a negative return (Dunkley, 2016a). This search for yield is narrowing the spread between riskier assets and assets considered safe, creating a distortion between the actual risk of the assets and their current valuation (Hannoun, 2015). Furthermore, the negative interest rates could also possibly lead to extremely large asset prices causing the formation of bubble ready to explode. Therefore, as Hannoun (2015) stated, when the situation is normalised and the level of interest rates are soaring up, investors will suffer large and spread losses.

In addition, as Blot & Hubert (2016) analysed, the negative interest rates force banks to grant loans to previously considered uncreditworthy market players. Consequently, *ceteris paribus*, the total risk of financial institutions should increase.

The relation between the low interest rates and the risk-taking of banks has already been studied by researchers and it is unsurprisingly negative as stated by Delis and Kouretas (2011, p. 852):

The empirical analysis, conducted on a large panel of euro area banks, reveals a strong negative relationship between bank risk-taking and interest rates. Thus, the low interest-rate environment unambiguously increases risk-related bank assets and alters the composition of euro area bank portfolios towards a more risky position.

Consequently, although the policy makers have taken into account the potential increase in riskier activity carried out by financial institutions (Blot & Hubert, 2016), it is still from the highest importance to monitor the global risk of banks in order to proactively prevent a new financial crisis.

6.2 The Costs Reduction Pursuit

As it is mentioned earlier, banks have been focused lately in reducing their operating costs by reducing the size of their workforce. In addition, the banking industry is disrupted by the evolution of the digitalisation. Chiarella et al. (2016) stated in the McKinsey Corporate Market and Investment Banking Report that digitalisation was also the key to decrease the operating costs of financial institutions. However, digitalisation comes to a cost that is often dealt with outsourcing the activities abroad. The outsourcing operations are not “the new game in town” for the banking industry (Deftereos, 2016). Nevertheless, the digitalisation with the aim of cutting costs has exacerbated this effect with jobs being in majority outsourced to India, China and Poland (Dunkley, 2016b).

Hence, the combine effects of the negative interest rates and the digitalisation are forcing financial institutions to perform great restructurings of their business model in order to cut costs. These restructurings are often accompanied by massive layoffs. Thus, one might argue that the negative interest rates are damaging the employment in the banking industry. Furthermore, the restructuring costs are in addition to the low interest rate environment impairing the bottom line of financial institutions. Nonetheless, these immediate costs will generate higher future net income as concluded by ING Chief Executive Officer, Ralph Hamers, who estimates a yearly cost savings of €900 million by 2021 due to the restructuring of his bank (Van Tartwijk, 2016).

6.3 Fee and Commission Income: The Holy Grail?

Finally, the introduction of negative interest rates and the low interest rate environment raise another question: should banks increase their fees and commissions in order to compensate for their squeezed net interest margin? Indeed, we have seen that customers are reluctant to a negative interest rate on their deposit accounts. Consequently, banks could raise their fees on the namely deposit accounts as a “disguised” negative interest rates. Blanke and Krogstrup (2016, para. 27) explained that:

Fees basically amount to a negative interest rate. If you pay a \$60 annual fee (or \$5 monthly maintenance fee) on your deposit account, and you hold an average of \$2,000 in that account, it's the equivalent of paying a negative 3% interest rate.

Kok et al. (2016) found indications, contradictory to our findings, that the financial institutions have already shifted their business models towards a more fee and commission income oriented business model. They further conclude that the stronger focus on the fee and commission income could potentially bring diversification in the income sources of financial institutions. However, they also pointed out that a greater dependence on the fee and commission income could deteriorate the financial stability of banks depending on the type of fees and commissions they are more relying on and if it is in accordance with their intended business model. These results are consistent with the study done by Lepetit et al. (2008) which is mentioned earlier in this master thesis (see Section III.1.2).

Turk (2016) found that the higher fees and commissions would not be sustained in the future due to the increased competition in the banking industry forcing financial institutions always to propose lower price in order to corner the market.

6.4 Limitations

Throughout the realisation of this master thesis I encountered several limitations and simplifications that could alter the results brought forward by this master thesis. Hence the results are to be taken with consideration of these limitations and simplifications. Furthermore, more granular research has to be done to unveil the specific impact of the negative interest rates on the profitability of financial institutions and the benefits brought by using this unconventional monetary policy in the future.

6.4.1 Data and Clustering

First of all, as mentioned in the methodology, the clustering is more related to an art than to an exact science. Thus, the results of the clustering and the number of clusters could represent a distorted version of the banks in reality. Furthermore, we also insist on the fact that, ever more since the crisis, financial institutions are not relying on one particular business line such as the investment, the retail or the wholesale banking. On the contrary, they perform a wide range of activities that are attached to a specific business model in order to diversify their activities.

Nevertheless, each bank is to a certain extent more related to a specific business model. In addition, the clustering allows us a more granular analysis of the impact of the negative interest rates on the banking industry.

Moreover, we deliberately selected the largest European financial institutions. This decision could bear one significant consequence. The smaller banks have been known to engage themselves in more retail activities and avoid the trading and asset management activities. Furthermore, these small banks have less access to the longer-term refinancing operations and targeted longer term refinancing operations set by the European Central Bank. Finally, the smaller banks rely more on the deposit of their customers in order to provide loans to other customers. Hence, thanks to our analysis, we could evaluate that the negative interest rates should theoretically affect in a greater way the profitability of these smaller banks.

Furthermore, our sample size is composed of 25 banks which represent 200 bank-year observations. Although, it allows to draw some conclusion on the potential impact of the negative interest rates, the size of the sample should be extensively enlarged in order to draw significant results that could be used in further research. Moreover, with some smaller banks such as the Banco Popular Espanol SA and the Unione di Banche Italiane SpA, the financial information was intricate to find due to the country specific financial reporting standard or was nonexistent. Thus, simplifications have been made in order to compare the bank included in the sample.

Finally, we compare banks that are located in different countries. It has to be pointed out that the economic situation of a country has a strong impact on the bank profitability and bank earnings in general. Firstly, as Jobst and Lin (2016) mentioned countries such as Portugal, Spain and Italy where the credit growth has remained low in comparison to those of Germany and France and well below the level in order to preserve the net interest margin in these countries. Moreover, these same countries contain a significant part of variable rate loans in regard of the total loans towards the non-private sector (see section III.3.2) which could undermine the profitability of the banks when the rates adjust to the current level of interest rates in the Eurozone. Last but not least, the direct cost of the negative interest rates (i.e. the cost of detaining excess reserves at the ECB) is impacting on a greater scale banks that are located in countries where they hold larger surplus reserve in order to protect themselves (Jobst & Lin, 2016).

6.4.2 Impact of Other Unconventional Monetary Policies

While this master thesis has been exclusively focused on the negative interest rates, in the meantime of their introduction, the European Central Bank has launched other unconventional monetary policies. Firstly, the ECB has been buying large amount of assets known as the asset purchase program (APP) or direct quantitative easing.

The direct quantitative easing is in essence the massive purchase of any assets. However, in reality, central banks focus on purchasing longer-term sovereign bonds from financial institutions. Indeed, these operations bear a double goal. Firstly, government bonds are considered as a benchmark for riskless assets. Hence, the sovereign yield is used as a proxy for the riskless rate. As the ECB is massively purchasing longer-term government bonds, the yields associated with them is falling which, consequently, will induce that the yield on riskier assets plunge as well. This represents the first goal: the quantitative easing reduce the longer-term interest rates which will ease the credit conditions and boost the longer-term investments (Bini Smaghi, 2009). Secondly, financial institutions benefit from the sale of their sovereign bonds and can transform this acquired liquidity into loans to non-financial corporations and households. Nevertheless, if they decide to hoard the net proceeds of the transaction and park the money on the deposit facility of the ECB, the second effect/goal is nullified (Bini Smaghi, 2009).

We can easily see that the quantitative easing and the negative interest rates works in the same way by decreasing the overall level of interest rates and are simultaneously complementary. Therefore, a limitation to the analysis of the impact on the profitability of the negative interest rates is to dissociate the impact attributable to them and to the direct quantitative easing. Furthermore, the APP also boosted the profitability of financial institutions by allowing them to sell inflated sovereign bonds due to the low interest rate they bear.

Secondly, the European Central Bank also used forward guidance as an unconventional monetary policy in order to stimulate the inflation. The main effect of the forward guidance is to lower the interest rates and flatten the yield curve. Hence, we face the same issue as with the quantitative easing as to isolate the sole impact of the negative interest rates.

Conclusion

Although they have been theorised for a long time, the negative interest rates have created a great shockwave in the financial world following their introduction in 2014 by the European Central Bank. First, they raised the question of passing the negative interest rates on the deposit accounts of bank customers. Then, banking industry actors accused the negative interest rate policy to harm their industry and, consequently, diminish the profitability of banks. Therefore, the aim of this master thesis is to assess the impact of the negative interest rates on the European banks' profitability and determine the validity of our three hypotheses which are:

- Negative interest rates have impacted more severely the retail and wholesale banks.
- As the first hypothesis is ruled out, we put forward that the banks have changed their sources of income.
- As hypothesis two is ruled out, we further hypothesise that the negative interest rates have indeed enhanced the credit growth.

Moreover, it is intended to uncover if any type of business model has been granted an advantage thanks to the NIRP. Following our empirical results and analysis we can draw several conclusions that can be summarised in two parts.

Business Models' Profitability

First of all, negative interest rates have not impacted significantly the profitability of each bank business model since their introduction. A fortiori, they increased the returns of banks in the short term. Nevertheless, we can observe a large plummet in the return on equity of retail and wholesale banks in 2016. These results can be explained by multiple reasons. Firstly, financial institutions have not changed their source of income generation strategy since the introduction of the interest rates. Retail banks and wholesale banks are still relying heavily on the net interest income and investment banks are still focused on the asset management as well as the advisory/consulting activities. This result can be interpreted because the government forced financial institutions to refocus their activities on traditional retail activities in order to receive state aid. Secondly, banks' liabilities such as deposit accounts are associated to the short-term interest rates while their assets are linked to the longer-term interest rates. When the interest rates are cut due to expansionary monetary policies such as the negative interest rates, the short-term interest rates are adjusting more quickly than the longer-term interest rates.

Hence, the margin between the rates on their liabilities and assets is widening. Thirdly, the asset prices are inflated thanks to the low interest rates set by the negative interest rates. In addition, financial institutions are fixing their fees and commissions as a percentage of the worth of the assets they manage. Thus, negative interest rates allowed banks to increase their fee and commission income by increasing asset prices.

Nevertheless, these effects have a relatively short-term lifespan. Indeed, the longer-term interest rates are eventually following the short-term interest rates. One key observation is that the long-term interest rates are decreasing in a larger extent because the short-term interest rates which are linked to the deposit accounts are bounded by the zero-lower bound. This bound emanates from legal and/or strategic reasons. Indeed, banks fear that by applying negative interest rates on their deposit accounts, they will lose their deposit fund base because customers would withdraw their money from their deposit accounts. Hence, financial institutions should increase their total loan volume in order to counteract the squeezed net interest margin. However, we have shown that although it has in fact increased for the majority of banks, the soar up was not substantially large enough to mitigate the negative interest rates impact. In addition, the retail and wholesale banks have been anticipating the worse income generation by performing significant restructuring plans following the introduction of the negative interest rates. These restructuring plans bear large initial costs which are translated in an undermined net income of financial institutions. Finally, in order to be Basel III compliant and reflect a safer as well as a better image of their banks, each business model has increased its equity-to-asset ratio. Consequently, in the longer term, retail and wholesale banks have experienced lower profitability.

Therefore, we can conclude that, on the long-term, the negative interest rates have given an advantage to banks closely related to investment banks because of their business model relying more on the fee business. However, as discussed earlier, retail and wholesale banks could also raise their fees with the aim of mitigating the impact of the negative interest rates.

Further Cut and Prolonged Negative Interest Rates

The negative interest rates had a mixed impact on the credit growth and the loan expansion. Moreover, consumers have chosen in certain cases to extend their savings rather than spending into the economy in order to maintain their saving goal (P. Ledent, personal communication, March 14, 2017). Hence central banks could decide to prolong the negative interest rates.

However as titled by Claes et al. (2017), low interest rates level for an extended period would deeply harm financial institutions as their profitability would extensively decrease.

Finally, as stated by Coeuré (2016), the ECB has set the deposit facility rate under the zero lower bound but it has not yet lowered the interest rate to the effective lower bound (see Section II.1). Consequently, the European Central Bank could further cut the interest rate on its deposit facility with the aim of further enhancing the credit growth. Nonetheless, Brunnermeier and Koby (2017) demonstrated that the interest rates have a reversal rate which is the situation where the unconventional monetary policy has the opposite effect of its intended credit growth goal. Studies show that the ECB has not reached the reversal rate but further cut would eventually reach it and harm significantly banks' profit and the economy as a whole (Asterlind et al. 2016; Coeuré, 2016; Witmer & Yang, 2016).

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