



# Capital buffers in the EU after the financial crisis: Why different macro-economic situation matters.

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## **Abstract**

In this thesis, the capital buffers, operationalized as bank capital to asset ratio, will be examined in the 28 European Union member states in the period of 2008-2016. The influences of gross domestic product growth, government debt in percentage of GDP and the unemployment rate of the active population will be researched. Furthermore, the convergence model will be used to study whether these economic conditions are needed in order to move toward the 8% minimum capital requirement. The impact of these three factors on the capital buffers is studied with a panel data research design. The goal of this research is to see what the effects of the three factors are and what the causal mechanism behind it is. Both GDP growth and government debt have in general a positive and significant effect on the capital buffers. This shows a cyclical behavior behind the positive and significant effect between the capital buffers and GDP growth. The positive and significant correlation between capital buffers and government debt is explained by the expansionary fiscal policy of the EU member states, which makes more money available in the economy. Therefore, the capital buffers increase. The capital buffers are negatively correlated with the level of unemployment. This thesis shows that these macro-economic circumstances influences the capital buffers of the EU member states and shows that the capital buffers behave counter-cyclical.

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## **1. Introduction**

The financial crisis made a deep impact on the economy and financial sector of the entire world, the European Union (EU) included. One of the main reasons that it could happen was lack of regulation in the period before the financial crisis (Moschella & Tsingou, 2013: 407). One important regulation tool is minimum required capital for a bank. This minimum requirement determines what the minimum capital buffer of a bank needs to be. Capital buffers are the capital that banks have relative to their asset and determine how much banks can lend to businesses and consumers. Therefore, it is a way to influence lending to the real economy. The minimum requirement for capital buffers are one of the most important regulation instruments and need to bring stability in the financial sector. The first capital requirements, in which the capital buffers are determined, go back to the first accord of the Basel Committee on Banking Supervision (Basel I) in 1988 (Quaglia, 2013: 19). The Basel II accord in 2004 and Basel III accord in 2013 are the most relevant for this research.

The Basel Committee on Banking Supervision was founded in 1974 in response to problems in the currency and banking market occurring around that time. The Basel Committee consists of all the members of the G20. They describe themselves as global standard-setters for banking regulation and a forum for support on banking supervisory issues (Peihani, 2015: 147). The mandate of the Basel Committee is improving the supervision, regulation and practices of banks all over the world with the general goal to enhance financial stability. The Basel Committee is not a formal supervisory authority with a legal position, so the decision does not have legal force. The decisions of the Basel Committee can therefore be described as soft law. The influence of the Basel Committee can be most clearly seen in the international implementation of the Basel agreements. They do not have the legal status of a treaty, but many countries have implemented them (Peihani, 2015: 148). The EU for example, has implemented the third Basel agreement (Basel III) in the form of Capital Requirement Directive IV (CRDIV) (Quaglia, 2013:19). The EU has acted on the advice from the Basel III agreement to set the minimum capital buffers for banks on 8% of the risk-weighted asset. This minimum is required for all the EU member states. The CRDIV was agreed on in 2013, but took effect in 2014 (BCBS, 2011: 7).

Capital buffers are important because it determines how much money banks can lend toward businesses and consumers. However, the average capital buffers of the banks differ among countries. One way to explain the differences is to look at the macro-economic indicators of the countries to give a plausible explanation for these differences. This is important

because capital buffers play an important role in the current economic system and the Capital Requirement Directives of the Basel III agreement were one of the important regulations to overcome the financial crisis of 2008. Therefore it is important to explain the causal mechanism behind the differences in capital buffers among countries to see to what extent the economic situation of a country influences their capital buffers.

One important subject concerning the capital buffers, which has been researched many times, is the cyclical behavior of the capital buffers. A capital buffer can be pro-cyclical, which means they increase during economic recessions. Alternatively, they can be counter-cyclical; in this case, they decrease during economic recessions (Gambacorta & Shin, 2016: 1). In this research there will be investigated whether the economic situations of the EU member states have a significant effect on the capital buffers of the member states and what the causal mechanism behind this correlation is. In this thesis not only the gross domestic product (GDP) growth is used as an indicator for the economic situation of a member states, two other variables are used, namely government debt and the unemployment rate. Using these two other variables gives a wider range of economic circumstances to research for.

Capital buffers are largely interrelating with the economy of a country. It influences the amount of money banks can lend to companies and consumers. On the other hand, there is the European regulation in the form of the Capital Requirement Directives of the EU (CRD's), especially the fourth implemented in 2014. This is also of big importance to the development of the capital buffers in the EU. The directive is meant to harmonize the capital buffers in the EU. It is important to understand how the mechanisms work that establish and influence the capital buffers. With that knowledge, the variation in capital buffers can be better understood and new policies can be based on improving the capital buffers so they fit in well with the economic development of the member states. Member states will understand better what the influence of the economic situations on the capital buffers are and will therefore be able to anticipate on this.

In this thesis, the reasons of the differences in the capital buffers of the EU member states are researched countries. There is chosen for the capital buffers in the EU member states, because Howarth and Quaglia (2013) showed that European member states had different preferences in the formation of the CRDIV. The data about the capital buffers is the median of the EU member states; thus, it makes it possible to compare the member states with each other. The EU offers a unique situation, because the member states have to implement the CRDIV. It gives the opportunity to research what effect the macro-economic situations of the member states have on the capital buffers, because all the member states have to implement the

minimum capital requirements given in the CRDIV. I argue that the macro-economic situations of the different member states have an important effect on the capital buffers of the member states.

The difference between my research and existing research is that I will focus on macro-economic effects, which may explain the differences in the bank capital to asset ratio. The focus will lay on the causal mechanism behind the macro-economic circumstances of the European member states and their bank capital to asset ratios. Most research about the cyclical behavior only considers GDP growth as a macro-economic variable. In this research, there will be more macro-economic variables, namely unemployment rate and the government debt. The advantage of adding these two variables is that it gives a deeper understanding on how multiple economic circumstances can influence the capital buffers. Other research has mostly focused on why the banks have different capital buffers because of the regulation, or if the capital buffers have a pro-cyclical working or counter-cyclical working on the economy. The focus of the cyclical behavior of the capital buffers is important because governments can learn whether their capital buffers work as intended.

There is lot of research aimed at the financial crisis, its causes and effects on society, and regulation that has come into effect as a result. Quaglia and Spendzharova (2017) studied why there were no international standards for the banking structure after the financial crisis. They linked domestic and international governance. Greenwood and Roederer-Rynning (2015) looked at the role of the European Parliament adapting legislation of capital requirement in 2013. Only the role of the European parliament was researched, not the effectiveness of the 2013 capital requirement regulation. Moschella and Tsingou (2013) claimed that regulation failures contributed to the financial crisis. They researched the process of reforms that took place after the financial crisis. I will investigate differences in capital buffers among the EU member states. There has also been research published about the cyclical behavior of the capital buffers.

I argue that the macro-economic situation also has an important effect on the size of the capital buffers. In other words, not only financial regulation determines the capital buffer of banks, but also the economic situation of a country determines the ability of banks to obtain capital buffers. The EU member states give hereby a unique situation. After Basel III, the EU implemented the fourth Capital Requirement Directive (CRDIV) in 2013, which gave all the member states the same goals to reach in 2019. It offers the opportunity to compare the 28 member states, which have to reach the same goals but have different macro-economic situations. The financial crises have different impacts on these countries and therefore also on

their capital buffers. The member states have multiple preferences on how to organize their financial markets. At the same time, the EU tries to harmonize the financial system in the whole EU.

To research whether macro-economic circumstances influence the bank capital to asset ratio, and what the causal mechanisms behind it are, in this research a panel research design will be used. The research will be retrospective; this means the research will focus on whether the economic situations of the member states have influenced their capital buffers. The focus will be on estimating the effect of different economic variables on the capital buffers of these EU member states, because I want to investigate whether the macro-economic situations of the member states influence their capital buffers. This also provides the opportunity to explain the causal mechanisms behind this interaction and see how the different variables influence the capital buffers of banks. The new capital requirements (CRDIV) are taken into account in the analysis. The observed period in this research is between 2008 and 2016, thus in the last three years the 8% minimum capital is required. This period has been selected specifically because it is nearly the most recent period that can be observed due to the available data. It is therefore a period that has not yet been researched in many studies, which makes this research relevant.

In the first section, background information will be presented about the capital buffers, the working mechanism behind them and how the Basel III agreement was implemented. The background section will be followed with a theory section, which set out the theories about capital buffers and the hypothesis that will be researched in the thesis. Afterwards the research design will be discussed. In this section the choice for a panel research design will be justified, the methods and techniques will be explained and the data that will be used in this thesis will be shown. In the next section, the results will be presented and discussed. Finally, in the conclusion the hypotheses will be evaluated and the research question: “To what extent does the macro-economic situation in the EU member states influence their bank’s capital buffers after the financial crisis of 2008?” will be answered.

## 2. Background

### 2.1 Capital buffers

“Capital buffers” refer to a bank’s capital holdings, which are required by a regulatory minimum (Carvallo Valencia & Ortiz Bolaños, 2018: 1). Raising the quality and level of capital in the financial system must ensure the effective loss absorbing capacity. The Basel Committee, responsible for making the Basel agreements, focuses on two dimensions: interconnection between banks and pro-cyclicality. A counter-cyclical buffer aims to ease the pro-cyclical dimension, and the higher loss absorbing capacity aims to solve interconnection between banks. The conservation buffer for common equity Tier 1 capital is currently set on 2.5%; this buffer protects banks against economic downturns (Bui, Scheule & Wu, 2017: 25).

A key objective in monetary policy is to unlock bank lending in the real economy in times of economic downturns. The European Banking Authority (EBA) carries out stress tests for European banks focusing on the capital adequacy of banks. Bank capital is viewed as a loss-absorbing buffer that increases bank solvency in times of adverse macro-economic shocks (Gambacorta & Song Shin, 2016:1). The Tier I Capital ratio is implemented to ensure there is sufficient capital in times of economic recession. Capital ratios are an important regulatory tool for the safety and soundness of banks (Chiaramonte & Casu, 2016: 140-141). The logic behind capital buffers is that when they are built in a pro-cyclical way, they decrease during economic growth and increase during economic recessions. When this is the case, banks are not able to dampen the losses during economic regressions, thereby worsening the outputs of economic fluctuations (Coffinet, Coudert, Pop & Pouvelle, 2012: 1111).

Ideally, capital buffers should work counter-cyclical. A stricter credit supply harms the transmission from banks to the real economy. When the capital buffers are lower, there is more lending of banks to the real economy (Gambacorta & Shin, 2016: 1). However, banks with a weak capitalization may increase their solvency by decreasing credit expenditures. When the whole bank system in a country is weakly capitalized, there will be tension between the monetary policy of increasing lending, and the objective of ensuring the solvency of individual banks (Gambacorta & Shin, 2016: 1). Thus, in economic recession when the banking sector is under pressure, the capital buffers of banks will be increased to ensure the soundness of banks. This can be seen as pro-cyclical.

An important concept that is closely related to capital buffers is banking instability or financial instability. Bekiros, Nilavongse and Uddin (2018) researched the effect of shocks to the capital of banks. In addition, they researched what these shocks mean for the banking

stability under the Basel II agreement. They operationalized banking instability as when the bank capital to asset ratio is below a certain point. The conclusion of their research was that under the Basel II agreement positive new shocks for future capital encourages banks to decrease their capital, capital to asset ratio and thus expand their credit supply. The decrease in capital to asset ratio leads to a ratio below the steady point and thus to instability in the banking sector (Bekiros et al. 2018: 328).

Therefore, financial stability a situation in which there is trust in the financial market of a country, and that the banks are able to pay their debts. Investors and other parties are also confident that the financial market of a country is able to fulfill their commitments (Bekiros et al. 2018). The relevance of financial stability lies in the fact that one of the reason to increase the capital buffers is to stabilize the financial sector.

## *2.2 Development of Capital Requirement Directive*

After the financial crisis of 2008, the European Union (EU) imposed increasing financial regulation. One of these banking regulations is the capital requirement for banks. This has traditionally been a method to ensure stability in the banking sector. The Basel Commission on Banking Supervision (BCBS) mentioned the capital requirements for banks in its first report in 1988, and updated it in 2004 (Quaglia, 2013:19). The EU has implemented this with the Capital Requirement Directive (CRD). There were multiple revisions of the CRD, in 2009 and 2010 the capital requirements were increased further.

In 2010, a new agreement was signed named Basel III, the CRDIV. In Basel III, the capital buffer was introduced and there was an outline of international rules of liquidity management. It can be concluded that these new rules increased the proportion of capital that must be of proven loss absorbing capacity. This is called Core Tier 1 capital. The implementation period is between January 2013 and 2019 (Quaglia, 2013: 19). Thus, capital requirements are the minimum level of capital banks have to hold, the capital buffers are a mandatory capital that banks are obligated to hold above the capital requirements.

The EU started implementing the Capital Requirement Directive IV based on Basel III in 2014. The CRDIV incorporates the element of the Basel III, the introduction of two capital buffers on top of the minimum capital requirement. There is also critique on the CRDIV of the EU. It may be modified too much so that it would meet the EU member state demands. The European Commission (EC) softened the Core Tier I capital in comparison with Basel III. The CRDIV was directly applicable without the need of national transposition. The regulation eliminated national divergence on the subject (Quaglia, 2013: 19).

### *2.3 Literature review*

According to the literature, there are multiple reasons why capital buffers vary across banks and/or countries. Fonseca and González (2009) studied 1337 banks in 70 different countries between 1992 and 2002. They found that capital buffers are positively correlated with cost of deposits and bank market power. However, this relation differs across various states because of different regulation, supervision and institutions. Capital requirements have stabilization effects, which can strengthen the stability of the banking system (Fonseca & González, 2009: 892). The incentives for a bank's shareholders to hold capital buffers depend on the cost of capital compared to the cost of deposits. This is because shareholders require higher returns in comparison to depositors to account for the higher risk they are taking. The logic behind this is that the returns shareholders want are positively related to the risk they are taking (Fonseca & González, 2009: 893).

In the research by Coffinet et al. (2012), the focus lies on to what extent capital buffers exacerbate the cyclical behavior of credit. They researched the relationship between GDP growth, capital buffers and loan growth. The research is on firm level on France banks in the period of 1993-2009. Their findings suggest mutually reinforcing mechanisms between loan growth and capital buffers. The results support a counter-cyclical capital requirement focusing on high-quality capital and loan growth smoothing (Coffinet et al. 2012: 1110). Capital requirements are likely to rise when the risk increases in times of economic downturns. When capital is more difficult to raise, there can be a credit reduction, which can deepen the recession. The Basel Committee (2011) tries to solve this problem by advocating for counter-cyclical capital buffers for banks in good times that are above the minimum capital requirement. In economic recession, banks can use this additional buffer.

Banks have incentives to have capital buffers above the minimum regulatory requirement. One reason is to avoid costs when the capital requirement falls under the minimum threshold, banks can also have higher capital buffers to avoid cash shortfall. Another reason is to increase confidence from shareholders, depositors and rating agencies. It is important to determine if capital buffers are built in a pro-cyclical way or not. A majority of studies find a negative link between capital buffers and the business cycle. There is also evidence of a positive relation between the business cycle and banks in the EU (Coffinet et al. 2012: 1111).

According to Howarth and Quaglia (2013: 337), there are three factors for the national preferences of capital requirements from EU member states. Namely, capital position, the structure of banking and financial systems and the different macro-economic concerns. The first factor is the capital position of banks. With the increasing Tier 1 Ratio, banks have two

options, to reduce their assets and therefore the lending, or retain earnings and thus increase their capital numerator. If banks reduce their assets, the profits will be lower. When banks retain earnings then discretionary payments like dividends on equity will decrease. Both of the actions banks can undertake will make them less attractive for investors. On the other hand, investors are also interested in the long-term stability of banks. Increasing capital requirements improve the long-term stability and therefore give banks an incentive to recapitalize (Howarth & Quaglia, 2013: 337-338).

Another factor is the structure of the banking and financial sector. Howarth and Quaglia (2013: 340) explain that French and British commercial banks are better capitalized because, on average, they are more dependent on equity finance than banks in France. Equity finance means that banks increase their capital through the sale of their shares. Many banks on the continent do not have equity finance. This is problematic in incorporating the Basel III agreement into EU legislation. The Basel III agreement was written with the assumption that banks are funded by equity finance. However, a large number of banks in the EU depend on other sources of funding.

The last factor is the different macro-economic concerns. Non-financial companies in Europe are mostly heavily dependent on bank credit finance. In Europe, there is also a comparatively limited role of corporate, equity debt, and the strong bank-industry link explains the preoccupation of European governments regarding the effects of Basel III on bank lending and the economy (Howarth & Quaglia, 2013: 342).

Looking at the implementation of the Basel III and the following CRDIV, the European Union has been enthusiastic about the Basel norms in the immediate aftermath of the financial crisis. The EC has used Basel III to harmonize the banking law in the EU (Atik, 2013: 289). After the financial crisis the EU has expanded its mandate to harmonize the national banking regulation. The Basel III agreement provides minimums for capital requirements, not maximums. The EU however has turned the Basel III norms into rules in which individual member states has no opportunity to implement stronger requirements for themselves. The implementation of Basel III by the EU has been haunted by two specters. A collapse of the Eurozone on the one hand and the deeper integration into a European banking union on the other hand. The first had been prevented, and the second is embraced (Atik, 2013).

To sum up, the EU has implemented the Basel III capital requirements as fixed obligations rather than a minimal standard. Leaving no room for individual's member states to set higher capital requirements on their national level. What follows from this different

implementation is that the EU selectively implements the norms set by the Basel III agreement.

### 3. Theory

In the next section, the theory behind the capital buffers will be discussed. This theory will be used to formulate the hypothesis of the thesis.

#### *3.1 Cyclical behavior of capital buffers*

Howarth and Quaglia (2013) argued that institutional characteristics of national banking sectors account for divergence in EU members state capital requirements. The main purpose of capital requirements is to limit the amount of advantage that financial firms can take on. The EU has the biggest internal market in the world and one of the largest financial jurisdictions on the planet. The United States (USA) are as main counterpart of the EU financial market, concerned about potential regularity arbitrage and competitive advantages for European banks as result of the EU implementation of Basel III (Howarth & Quaglia, 2013: 336-337). The European Commission softened the definition of Core Tier 1. One difference between Basel III and CRDIV is that Basel III was only for international active banks, whereas CRDIV was for all banks in the EU. This makes Basel III impossible to apply in some EU member states.

The link between the financial system and the real economy is that banks are a major source of funding for companies not active in the financial sector and the importance of bank lending to the real economy. When companies rely on credit from banks, instead of issuing securities or raising money on the stock market, higher capital requirements are more likely to cause a recession in the real economy (Howarth & Quaglia, 2013: 334). With higher capital requirements, banks can lend less money, thus less money flows to the real economy when companies rely on capital from banks.

Market power also plays a role in the capital buffers of banks. Banks with a large market share and therefore market power will be more risk-averse when competition is threatening them. When banks with market power charge rates, the rates can cause adverse selection for the borrowers. This increases the risks and forces banks to increase their capital buffers (Carvallo Valencia & Ortiz Bolaños, 2018: 1). According to Carvallo Valencia and Ortiz Bolaños (2018), capital buffers may also be affected by the business cycle. When banks do not build up buffers during economic booms, they will have not enough capital during economic downturns. This means that the costs of raising equity capital may force banks to deleverage assets to realize the minimum capital requirement given by their governments.

Carvallo Valencia and Ortiz Bolaños (2018) studied 3461 banks in 79 countries with regulatory and macroeconomic variables. They make a distinction between 54 developing countries and 25 developed countries. They found that a higher level of competition leads to

higher capital buffers in developed countries, and in developing countries, competition is associated with lower capital buffers. The competition-stability view applies for developed countries, and the competition-fragility view applies for developing countries. The competition-stability view means that when banks are ‘too big to fail’, these banks will take increasing risks because implicitly the public guarantees their safety. Competition-fragility on the other hand, means that competition leads to more risk-taking. Banks with market power have less incentive to get involved in high-risk activities because their ‘charter value’ is undermined. Charter value is the capacity of a bank to continue doing its business (Carvallo Valencia & Ortiz Bolaños, 2018: 4).

Furthermore, Carvallo Valencia and Ortiz Bolaños (2018) found in their study of bank behavior in 79 countries that on average, worldwide the bank capital buffers are negatively correlated with the growth of economic activities. This means that the buffers behave pro-cyclically. This is in line with Basel’s III counter-cyclical buffer tools. Taking a closer look at developed and developing countries, in developing countries the capital buffers behave pro-cyclically. In banks in developed countries, there is a positive effect, suggesting that the buffers behave counter-cyclically. However, this positive effect is insignificant (Carvallo Valencia & Ortiz Bolaños, 2018: 8)

In the study of Carvallo, Kasman and Kontbay-Busun (2015), 13 countries in South-America and the Caribbean are observed in the period between 2001 and 2012. In five countries, they found a negative significant relationship between capital buffers and GDP growth and in six countries a positive significant relationship between the two. In their research, they show evidence that capital buffers are more likely to vary in a pro-cyclical way in countries where the costs of adjustments are lower and capital requirements are less strict. The cost of adjustment refers to the cost of changing capital (Carvallo et al. 2015: 150). The financial crisis had underlined the importance of the macro-financial situation and the part banks played in the financial sector (Carvallo et al. 2015: 148).

The capital buffers can function in two opposite directions. First, capital buffers can function pro-cyclically. This means that capital buffers increase during economic recessions, which means that banks lend less money to the real economy. In economic good times the capital buffers decrease, which increases lending from banks to the real economy. Capital buffers can also work counter-cyclical. In this case, capital buffers decrease during economic downturns, which increases the amount of money banks lend to companies in the real economy. In economic good times, the capital buffers increase. This reduces the lending from banks to companies. There has been lots of research done in this area and some researchers found a more

pro-cyclical effect. However, the capital buffers are also influenced by decisions made on the bank level. This is mentioned in the section above.

Nevertheless, there are also counter-cyclical effects discovered (Carvallo Valencia & Ortiz Bolaños, 2018: 3). This has two different implications. On the one hand, in times of economic recession increasing capital buffers can reduce lending to the real economy. On the other hand, reducing capital buffers may increase lending, but it is not sure that in times of economic recession companies will also spend more money. A negative effect of reducing capital buffers in times of economic downturns is that it decreases the stability of the financial sector.

Basel III rules that, in short, the capital buffers of banks should work counter-cyclical. They should be increased during economic booms (Carvallo Valencia & Ortiz Bolaños, 2018: 2). However, I argue that the macro-economic situation of the host country is an important factor for the level of capital buffers banks have. The macro-economic situation matters because it determines the demand for loans. The capital buffers determine the amount a bank can lend. Thus when the economy is growing, the demand for capital increases, which has a negative effect on the capital buffers.

The interest rate also plays an important role, but within the research duration of this thesis, the European Central Bank (ECB) set the interest rate to almost zero (ECB, 2016). This makes it cheaper for companies and individuals to borrow money, which can also stimulate economic growth. However, it is not sure whether individuals increase their spending habits when the interest rate is low.

Thus, countries with relatively positive macro-economic circumstances want to maintain their pre Basel III buffers or not increase them too much, because this will decrease lending from banks toward the real economy. Countries with bad macro-economic circumstances are likely to try to increase their capital buffers to improve stability in their financial sector. Stabilizing the financial sector means that banks improve their liquidity in order to maintain their capability to pay bank loans because a collapse of the financial sector will have devastating consequences. The link between a weak macro-economic situation and an instable financial sector is that in economic downturns, the economy is shrinking. This leads to less demand for loans and a setback in the economy.

### *3.2 Hypotheses*

To make up the hypotheses for this study, first the dependent variable needs to be discussed. To measure capital buffers data about the bank capital to asset ratio is used. The average of the

bank capital to asset ratio over the whole EU-28 increased in the period from 2008 until 2016 (World Bank, 2017).

However, this is for all the EU member states combined. It is expected that member states that had less economic downturn during the financial crisis will have lower capital buffers than member states in which the financial crisis caused a deep recession. A deep recession causes financial instability, which can be tackled with higher capital buffers. Member states that did not have such instability do not want their banks to higher their capital buffers because this decreases bank lending to the economy.

In this thesis, the behavior of the European member states regarding these matters is explained in detail. A light will be shed on to what extent the economic variables GDP growth, unemployment and government debt influence the bank capital to asset ratio in the member states. In other words, in which way the national GDP growth, among other factors, has an effect on the bank capital to asset ratio.

One independent variable to see what effect economic growth has on capital buffers will be GDP growth. This shows the growth of the economy of the member states, and therefore it is expected that member states that experienced a large decline in GDP will have higher capital buffers. The logic behind this is that in member states with GDP growth, the government wants to maintain the lending from banks to the real economy and therefore want to have relatively low capital buffers. In member states with GDP decline, the increasing capital buffers need to stabilize the financial sector. However, all the member states need to implement the CRDIV.

The first hypothesis will be:

‘GDP growth is negatively correlated with bank capital to asset ratio.’

The second independent variable is government debt in percentage of GDP of the EU member states. One of the big problems during the financial crisis, which was related to the government debt, was the high level of unemployment combined with high levels of government debt. In times of crisis, governments have fiscal policy instruments and monetary policy instruments to counter the economic recession. Monetary policy mostly has to do with interest rates, and fiscal policy has more to do with government spending and tax cuts/increases (Li, 2013: 3904-3905). When in times of crisis the government debt increases, this is likely because of counter-cyclical fiscal policy. Taxes are lowered and government spending increases to stimulate the economy. This increases the government debt.

However, there are three possibilities when the government debt increases but a country is implementing pro-cyclical fiscal policy. One explanation is a member state trying to reduce the government debt with cutbacks and reforms. If the government debt keeps increasing, the interest rate of the government debt will increase. This will be expensive for a country. Instead of an expensive counter-cyclical fiscal policy, the country chooses to reduce their government debt to ensure that it can fulfill its obligations. With the cutbacks, the government debt can be controlled. However, the economy will not be stimulated with this kind of fiscal policy, and the government debt can still increase due to the high interest rate and less government income because of the economic recession.

Another possibility can be that the EU demand cutbacks in order to obtain financial support, which occurred in Greece for example. The EU in cooperation with the International Monetary Fund (IMF) offered Greece a loan under the condition that Greece would cover its own government debt. This agreement was reached in 2010. External factors led to reforms in Greece own state administration (Featherstone, 2015: 295), but the government debt of Greece still increased between 2008 and 2016 (Eurostat, 2017c). Therefore, a large government debt and external factors as foreign demands for reforms can create a pro-cyclical fiscal policy. A third possibility is that time lag causes pro-cyclical fiscal policy. Time lag means that it takes some time to pass counter-cyclical policy through the legislative body and it takes time to implement it. This means that fiscal policy may be active when the economic situation in the country has changed and the stimulating fiscal policy is no longer needed (Tsuzuki, 2016: 216).

The government debt has an important role during the financial crisis. It is expected that member states with a high government debt have a more expansionary fiscal policy and are more likely to increase the capital buffers. The logic behind this is that stimulating the economy and increasing the capital buffers indicates a countercyclical mechanism in line with the CRDIV. The member states need to increase their government debt to fight the financial crisis and are therefore more eager to establish the minimum threshold for bank capital to stabilize their financial markets. Member states with relatively low government debts will most likely have a stable financial market, and therefore will have no need to increase their capital buffers rapidly. It needs to be taken into account that all the member states need to increase their buffers according to CRDIV, but member states with a high government debt will have a higher increase in buffers compared to the member states with low government debts.

The second hypothesis will be:

‘Government debt is negatively correlated with bank capital to asset ratio.’

To study the economic situation in the member states a third independent variable will be used. This will be the level of unemployment. In other research on the cyclical behavior of capital buffers, the GDP growth variable is used most often. However, this is not the only way to measure the state and development of an economy. A high unemployment rate indicates that the economy is not doing well or is even in a recession.

In general, there are three main forms of unemployment: structural unemployment, cyclical unemployment and frictional unemployment. Structural unemployment is mostly described as unemployment initiated by long-term mismatches between supply and demand for labor. Cyclical unemployment refers to temporary labor market conditions. In a situation of high conjecture, the unemployment decreases and vice versa (Quercia, Pennington-Cross & Tian, 2016: 347). Frictional unemployment occurs when employees switch between jobs and have a period between the two jobs where they do not have work. (Michaillat, 2012: 1721). The focus will lie on cyclical unemployment, because in this thesis the cyclical behavior of the capital buffers is observed. The research duration is also rather short to try to observe structural unemployment.

Thus, to make a second observation of the state of the economy of the member states, the rise or decline of the unemployment rate in the member states will be observed. A high unemployment rate is a sign of economic recession. Therefore, when it declines, this is an indicator of economic recovery. When unemployment rises, it may be an indicator of economic recession. I use the same logic with the GDP variable. Therefore, member states with high unemployment rates or an increase in unemployment will try to stabilize their economy and therefore increase their bank capital to asset ratio. Member states with lower unemployment rates or a decline in unemployment rate will prefer lower capital buffers to stimulate lending from banks to the real economy.

This leads to the third hypothesis:

‘High unemployment is positively correlated with bank capital to asset ratio.’

Last, there will be researched whether economic conditions are needed to move to the 8% minimum capital buffer determined by the CRDIV. To check for this assumption, the interaction between the growths in bank capital to asset ratio, the distance between the bank capital to asset ratio and 8%, and the economic circumstances will be studied. This interaction gives the opportunity to answer the question whether economic circumstances are needed to move towards the 8% capital buffer.

The forth hypothesis will be:

‘The distance between the bank capital to asset ratio and 8% is positively correlated with the growth of the bank capital to asset ratio.’

#### **4. Research design**

In this section, the research design will be explained as well as what the common threats of interferences are. The methods and techniques, and the data will be discussed afterwards.

##### *4.1 Concepts and operationalization*

The first important concept is the “business cycle” which are the periods of economic growth and economic downturns. This will be used to study whether capital buffers behave pro or counter cyclically toward the economy. Pro-cyclical is defined as when the economy is growing, the capital buffers are declining. Counter-cyclical is defined as when the economy is growing, the capital buffers are also growing.

The dependent variable will be the capital buffers of the EU member states, which is operationalized as average bank capital to asset ratio. The bank capital to asset ratio indicates whether a bank has enough capital to support their assets.

The first independent variables for the economic situation of a country is the growth in GDP. It is important to control for the economic situation of the EU member states, to evaluate whether the economic situation of the member states matters for the capital buffers. The GDP growth is a major variable to illustrate the economic cycle.

The second independent variable is the government debt in percentage to GDP. Government debt is an indicator whether a country is implementing a pro-cyclical or counter-cyclical fiscal policy. If the government debt is high, it indicates that a government is increasing its spending and/or lowering its tax revenue to stimulate the economy. However, it could already have been high, but an increasing government debt most likely indicates a stimulating fiscal policy from the government. Another explanation for the increasing government debt is that in time of crisis the tax revenues decrease and thus the government debt increases. In this thesis, the total amount of government debt in percentage of GDP will be used. This is important because the capital buffers also have a pro-cyclical or counter-cyclical effect. In the analysis, government debt in percentage of GDP has been chosen because it provides a clearer picture of how high the government debt is relative to the total economy of a member state. For example, the Netherlands has a higher total government debt than Greece. However, looking at the government debt in percentage of GDP it becomes clear that Greece has a far higher government debt in percentage of than the Netherlands (Eurostat, 2017c).

The unemployment rate is the third independent variable to evaluate the macro economic circumstances of the EU member states. The unemployment rate matters because it gives another indicator of how the economy is functioning. A high level of unemployment for

example, indicates a time of economic downturn. Unemployment is operationalized as the level of unemployment as a percentage of the active population. The advantage of using the level of unemployment as percentage of the active population is that the unemployment can be compared across nations. Namely, the inactive population can vary across countries. Thus to use the active population gives a better representation of the Labour market.

#### *4.2 Research approach*

In this thesis, regression analysis modeling the dependent variable asset ratio, and the three independent variables, GDP growth, government debt and Unemployment. A panel data set of the 28 EU member states will be used. This presents the opportunity to evaluate all 28 EU member states over the x-year period to see whether their economic situation has an effect on their bank capital to asset ratio. The relevant period will be from 2008 until 2016. This period presents the opportunity to start the data analysis right when the crisis started. The advantage of this most recent data is that most studies have not yet researched this period. Some ended in 2008 or 2013. This adds more relevance to the research. The average bank capital to asset ratio of the EU member states will be evaluated and it will be researched what effect the three independent variables had on it. The panel design makes it possible to analyze all 28-member states with the relevant variables of the member states' economy. Therefore, the results offer a good representation of the bank capital to asset ratio and whether they are related to the macro-economic situation of a member state.

#### *4.3 Unit of analysis*

The unit of analysis will be the EU member states. Therefore, the population will be the EU member states. The focus will lie on the EU member states because the EU provides a unique situation where multiple countries are bound to the same regulation. The countries have macro-economic circumstances, which can influence the height of the capital. They all have their own fiscal policy as well; in which they can influence their countries bank capital to asset ratio. The available data provides the opportunity to evaluate the economic situation within member states and to what extent this influences the capital buffers. The level of analysis is on the country level. The justification for using the national bank capital to asset ratio lies in the fact that this makes it possible to compare the macro-economic data of the member states with the ratios.

#### *4.4 Common threats to inference*

The lack of financial regulation was actually one of the causes of the financial crisis (Moschella & Tsingou, 2013: 407). However, a reverse causality can be the case in this research, because it is possible that the size of capital buffers influences the real economy by the increase or decrease in lending. Most research has been about the correlation between GDP growth and capital buffers, thus I expect that it is more likely that the economy influences the capital buffers than vice versa. The Capital Requirement Directive of the EU is also likely to influence the capital buffers, thus to see whether the member states have implemented it, the Directive needs to be considered in the analysis.

Another possibility is that other variables influence the capital buffers. It is possible that banks have multiple incentives to have higher capital buffers than the minimum regulatory requirement (Coffinet et al. 2012: 1111). Therefore, this may also influence the capital buffers instead of the macro-economic developments in the member states. The only way to find this out is to research whether there is a significant relationship between capital buffers and/or GDP growth, government debt and unemployment rate, but there is the possibility of an omitted variable bias (OVB). This means that there are not enough control variables in the regression. These missing variables can also explain the correlation in the regression, but they are not included (Angrist & Pischke, 2014: 69).

To overcome the OVB, there is chosen for panel data to control for unobserved country level variables. Therefore, the variables control for a long period of time, which narrows the OVB.

#### *4.5 Methods and techniques*

For the analysis, a panel data regression will be used. This gives the opportunity to use information in the cross-section and time-series (Lembcke, 2010: 54). A great advantage of panel data analysis over cross-section is that it allows great flexibility in modeling different behavior across groups (Greene, 2010: 284). One of the first things that needs to be done is to check whether a fixed effect regression or a random effect regression need to be implemented. Fixed effects control for unobservable, but constant differences in the cross-section units. Random effects on the other hand, are an estimator for the weighted average between-effects and fixed effects. Between-effects are, in this sentence, running the regression of means by cross-section identifiers (Lembcke, 2010: 54-55). A method to see whether the random effects or the fixed effect need to be used is the Hausman test. The null hypothesis has no difference, and when there is no difference, the random effect needs to be used. This is the case when the

result from the Hausman test is insignificant, which is when prob>chi2 is bigger than 0.05 (Lembcke, 2010: 56).

In the regression analysis, used for this thesis, the dependent variable, bank capital to asset ratio (asset ratio) will be regressed with the three independent variables: GDP growth, government debt and the level of unemployment (Unemployment).

The equation for the panel regression with random effect is:

$$BUF_{it} = \beta_1 GDPG_{it} + \beta_2 DEBT_{it} + \beta_3 UNEMP_{it} + \alpha + u_i + \varepsilon_{it}$$

The symbols stand for:

BUF: dependent variable (asset ratio)

i: entity (Country)

t: time (Year)

GDPG: independent variable (GDP growth)

DEBT: independent variable (government debt)

UNEMP: independent variable (Unemployment)

$\alpha$ : unknown intercept for the entities

$\beta_1$ : coefficient for independent variable (GDP growth)

$\beta_2$ : coefficient for independent variable (government debt)

$\beta_3$ : coefficient for independent variable (Unemployment)

u: between entity-error

$\varepsilon$ : within-entity error

This equation is a linear regression model. In the random effects model the  $u_i$  is a random effect that is a group specific random element. It is comparable to  $\varepsilon_{it}$ , however for each group the linear regression is identical in each period. The critical distinction between random and fixed effects is whether the unobservable individual effects represent elements that are correlated with the regressors in the model (Greene: 2010: 285). When this is the case, it possibly is more appropriate to model the individual specific constant as random distributed across cross-section units. This approach is proper if the sampled cross-sectional units are drawn from a large population. An advantage of the random effects model is that it sincerely reduces the number of parameters that need to be estimated (Greene, 2010: 285-286).

The equation for panel regression with fixed effects is:

$$BUF_{it} = \beta_1 GDPG_{it} + \beta_2 DEBT_{it} + \beta_3 UNEMP_{it} + \alpha_i + u_{it}$$

The symbols not appeared in the random effects equation stand for:

$\alpha_i$ : unknown intercept for each country

In this equation,  $\alpha_i$  embodies unobserved time-invariant country effects. In the model of fixed effects,  $\alpha_i$  is a group specific constant term in the regression (Greene, 2010: 346). The assumption on the fixed effects model is that omitted effects are correlated with the included variables (Greene, 2010: 285).

The study the forth hypothesis, about the influence of economic circumstances on the bank capital to asset ratio growth, the absolute convergence model will be applied by the panel data regression with fixed effects. The Hausman test showed that the fixed effect model should be used. The  $\text{prob} > \chi^2$  was smaller than 0.05. The dependent variable will be the growth of the asset ratio from  $t$  to  $t+1$ . As independent variable, the distance between asset ratio and 8% in  $t$  will be used, and the economic circumstances in  $t$ . This are the GDP growth, government debt and the level of unemployment. With the absolute convergence model, there can be seen whether the European member states are moving toward the 8% capital buffer.

#### 4.6 Data

The dependent variable is asset ratio; the World Bank provides the data, which is the bank capital to asset ratio. The World Bank has extensive data about EU member states and their bank capital to asset ratio. The data is provided by countries according the Financial Soundness Indicators. The ratio is reported yearly with a median aggregation method. The bank capital to asset ratio data is provided by the member states themselves. The aggregation method is according to the median. The World Bank provides only data on the country level; therefor data of individual banks is not included in this research. However, there are some missing variables, because the World Bank only provided data from Hungary until 2012, Slovenia until 2010 and Sweden until 2015. The number of observations is 241. Therefore, the individual results of Hungary (four years missing), Slovenia (six years missing) and Sweden (one year missing) need to be evaluated carefully.

Eurostat provides the data for the three independent variables. The first independent variable is the GDP growth. Eurostat presented the annual GDP growth in percentage of the GDP of the EU member states.

The government debt is the second independent variable. It is presented by Eurostat as the total government debt of a member state in percentage of the GDP.

The last independent variable is the unemployment. Eurostat presented it as the level of unemployment as percentage of the active population. Furthermore, are no missing variables with the three independent variables in the period between 2008 and 2016.

In Table 1, the descriptive statistics of the dependent variable and three independent variables are shown.

Table 1: Descriptive statistics

| Sum          | Mean   | Std.Dev. | Min   | Max     | N   |
|--------------|--------|----------|-------|---------|-----|
| Asset ratio  | 7      | 2.5312   | 3.219 | 14.2242 | 241 |
| GDP growth   | 0.8706 | 3.8404   | -14.8 | 25.6    | 252 |
| Govern debt  | 64.79  | 35.2854  | 4.5   | 180.8   | 252 |
| Unemployment | 9.6123 | 4.6443   | 3.4   | 27.5    | 252 |

In 2013, the EU made up the CRDIV, which started in January 2014. The total amount of capital that needs to hold is minimum 8% of their risk-weighted asset and of the total amount; it should at least be 4.5% common equity Tier 1 capital. To make a rough indication, the bank capital to asset ratio will be used as an indicator of total amount of capital of the risk-weighted asset.

## 5. Results

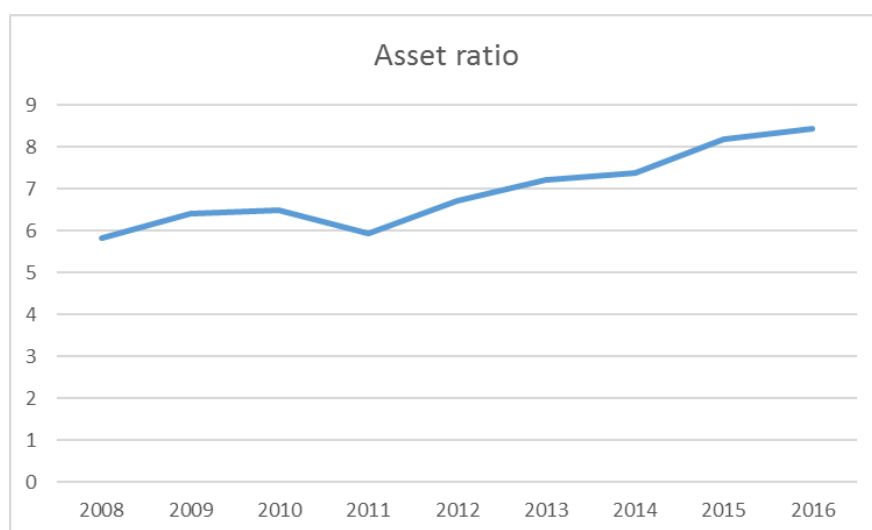
In this section, the results of the data analysis will be presented. Afterwards the results will be analyzed in the discussion section.

### *5.1. Capital buffers in 2008-2016: Descriptive statistics*

During the period of observation, the average asset ratio of all the EU member states combined increased from around 6% in 2008 to more than 8% in 2016. In figure 1 is the EU average bank capital to asset ratio shown. 2015 was the year, that on average, the member states passed the 8% threshold set by the Capital Directive IV. Taking a closer look at the individual member states in table 7 (see appendix), there can be distinguished three groups. The first has in all the observed years an asset ratio below the 8%. These countries are: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Italy, Luxembourg, Netherlands, Spain, Sweden and the United Kingdom. Furthermore, there are also member states with an 8% asset ratio or higher in the period of observation. These member states are: Bulgaria, Croatia, Cyprus, Estonia, Slovenia and Slovak Republic. Last, there are member states who in some years have a lower than 8% asset ratio, and in other years a higher than 8% asset ratio. These member states are: Cyprus, Greece, Hungary, Ireland, Latvia, Lithuania, Malta, Poland, Portugal and Romania.

In 2015, the bank capital to asset ratio of the whole EU was higher than 8%. Looking at the individual member states, Bulgaria, Croatia, Cyprus, Estonia, Latvia, Lithuania, Poland and Slovak Republic had the 8% bank capital to asset ratio in 2014 and before. Greece and Ireland had the 8% bank capital to asset ratio in 2014, but not before the implementation of CRDIV. Portugal and Romania had the 8% bank capital to asset ratio in 2015. The other member states did not reach the 8% minimum in 2014 and afterwards. Later in the results and the discussion, this minimum capital threshold will be used to evaluate the results.

Figure 1: EU average bank capital to asset ratio (%)



## 5.2 Results

In this section, the dependent variable asset ratio will be regressed with the three independent variables in a multi-variable regression. There will be researched if these independent variables (GDP growth, government debt and Unemployment) have a positive or negative effect on asset ratio.

The first important step is to observe whether the fixed effects needs to be used or the random effects. This is done with the Hausman test. When the three independent variables are regressed together in one panel regression, the  $\text{prob} > \chi^2$  is below 0.001. This indicates that the fixed effects model needs to be used, because the null hypothesis of no difference can be rejected. In table 2, the results are shown. The coefficients of the first two independent variables are positive and significant. The positive and significant correlation between asset ratio and GDP growth indicates that when the GDP growth is increasing with 1%, the asset ratio increases with 0.14%. The positive and significant correlation between asset ratio and government debt means that when the government debt increases with 1% point, the asset ratio increases with 0.04% point. The independent variable Unemployment is negative in the fixed effect model. This means that when the Unemployment is increasing with 1%, the asset ratio is decreasing with 0.06%. The result is however not highly significant. In table 8, (see appendix) the three independent variables are regressed with asset ratio and the dummy variables for each member state are added. This gives an overview of the individual member states as well.

The  $R^2$  within is in both the fixed effect model as in the random effect model the strongest. The  $R^2$  determines the explanatory power of the model. The  $R^2$  within of 0.352 means that 35.2% of the variation of asset ratio is explained by the independent variables.

Table 2: Multi-variable regression of asset ratio, fixed and random effect model

|                        | fe                    | re                     |
|------------------------|-----------------------|------------------------|
| GDP growth             | 0.1368***<br>(0.0196) | 0.1543***<br>(0.0206)  |
| Govern debt            | 0.0448***<br>(0.0078) | 0.0198***<br>(0.0068)  |
| Unemployment           | -0.0627*<br>(0.0364)  | 0.0286<br>(0.0349)     |
| Constant               | 5.0954***<br>(0.3665) | 5.8533***<br>(0.5010 ) |
| R <sup>2</sup> within  | 0.3520                | 0.3212                 |
| R <sup>2</sup> between | 0.1571                | 0.0517                 |
| R <sup>2</sup> overall | 0.0305                | 0.0030                 |

Observations: 241.

Number of countries: 28.

Standard errors in parentheses:

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

The positive and significant correlation between asset ratio and GDP growth indicates that in good economic times, the asset ratio is growing, which narrows the lending of the banks into the economy. The asset ratio functions counter-cyclical. This is in line with the Capital Directive IV, because the asset ratio behaves counter-cyclically.

To check whether the asset ratio functions pro-cyclical or counter-cyclical in relation to the government debt, it is useful to see how GDP growth and government debt are correlated with each other, with GDP growth as the dependent variable. The idea is to test whether there is positive effect between the two variables. If the correlation is positive, there is a counter-cyclical effect. The economy is growing, but because of taxes being cut and/or increasing expenditures, the government debt is growing. When the correlation between GDP growth and government debt is negative, this can indicate a pro-cyclical fiscal policy. The economy is growing but the government debt is shrinking. This can implicate that there are cutbacks in times when the economy is recovering, which indicate a pro-cyclical effect. On the other hand, the government debt can increase because when the economy is shrinking, the tax revenues are decreasing which leads to an increasing government debt. However, there are some problems with this approach. Stimulating fiscal policy could lead to import effect, which implies that when citizens have more money to spend due to fiscal stimulating policies, they will buy imported goods and therefore foreign companies will make the profits. This is mainly the case in open economies (Weeks, 2013: 58). Another issue is that if people have more money to spend

because of taxes being lowered for example, it is not sure that they will also spend it and thus stimulate the economy.

Looking at the results of Table 9 (see appendix); the overall effect between GDP growth and government debt is positive and significant. This means that a 1% point increase in government debt, leads to an increase of 0.04% point in GDP growth. The overall positive correlation between GDP growth and government debt indicates counter-cyclical effect. The government debt increases to make tax cutbacks and government expansions possible, to stimulate the economy.

The relationship between asset ratio and government debt is complicated, but in general, when the two regressions are analyzed of asset ratio and government debt and between GDP growth and government debt, both the correlations are positive and significant. The positive correlation between asset ratio and government debt, indicates that when the government debt is increasing, there is more money available. Because there is more money available, the asset ratio will increase, even if the GDP is decreasing.

The asset ratio has a negative but rather small significant relation with Unemployment. This means that when the level of unemployment is increasing with 1% point, the asset ratio decreases with 0.06% point. This indicates a counter-cyclical functioning of the asset ratio. The Unemployment is increasing, and the asset ratio is decreasing. The lower asset ratio therefore stimulates the economy by making bank lending onto the economy easier. This is exactly how the capital buffers should work according the Basel III agreement. However, it can also indicate that in times of high Unemployment, there is less money available in the economy due to times of economic downturn and therefore the asset ratio decreases.

### *5.3 The EU member states split into three groups*

In the Capital Requirement Directive IV was determined that the capital buffers need to be 8% or higher. However, not all member states have reached this 8% minimum. To see whether the macro-economic effects have different effects on these member states, the EU member states will be split into three groups. Group one, the high group, has a bank capital to asset ratio of above 8% in the entire period of observation. Group two, the medium group, includes member states which have over the whole period a bank capital to asset ratio of both above and under 8% minimum threshold. Group three has in the entire period of observation a bank capital to asset ratio of under the 8%.

### 5.3.1 Group 1, High asset ratio

The first group of member states, which have a bank capital to asset ratio of 8% or higher in the entire period of observation, will be discussed. These member states are Bulgaria, Croatia, Cyprus, Estonia, Slovenia and Slovak Republic. In table 3, the asset ratio is regressed with the three independent variables and the dummy variables for these member states.

Table 3: The regression of group 1: high asset ratio, fixed effects

| Variables              |                        |
|------------------------|------------------------|
| GDP growth             | 0.0352<br>(0.0325)     |
| Govern debt            | 0.0568***<br>(0.0153)  |
| Unemployment           | -0.1222**<br>(0.0546)  |
| Constant               | 10.4060***<br>(0.6117) |
| R <sup>2</sup> within  | 0.3415                 |
| R <sup>2</sup> between | 0.2623                 |
| R <sup>2</sup> overall | 0.4429                 |

Observations: 39.

Number of countries: 5.

Standard errors in parentheses:

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

The first correlation between asset ratio and GDP growth is positive but insignificant. To make assumptions of the effect is not useful, because it cannot be excluded that this relation is based on randomness.

The correlation between asset ratio and government debt in this group is positive and significant. This indicates that a 1% point increase in government debt, leads to an increase of 0.03% point of asset ratio. The positive and significant correlation indicates that when an EU member state is increasing its spending's and/or cut taxes, the asset ratio also increases. The asset ratio increases because due to the government increased spending and/or tax cuts, there is more money available in the country, which leads to an increasing asset ratio.

The last correlation is between the level of unemployment and the asset ratio. The correlation is negative and significant. This means that the asset ratio behaves in line with the Basel III agreement, because a growing unemployment indicates a bad functioning economy. When in times of economic downturn, the asset ratio increases, the lower asset ratio will stimulate the bank lending into the economy. Another explanation for the decreasing asset ratio

is that in times of high unemployment, when there is an economic downturn, the loans will go down. There will be less money available and therefore the asset ratio will decrease.

### 5.3.2 Group 2, Medium asset ratio

The next group that will be discussed are the member states, which have a varying bank capital to asset ratio. At some years, it is above the 8%, and other years it is below the 8%. In table 4, the group of member states with the medium bank capital to asset ratio are regressed with the three independent variables. These member states are Cyprus, Greece, Hungary, Ireland, Latvia, Lithuania, Malta, Poland, Portugal and Romania.

Table 4: The regression of group 2: medium asset ratio, fixed effects

| Variables              |                       |
|------------------------|-----------------------|
| GDP growth             | 0.2139***<br>(0.0329) |
| Govern debt            | 0.0417***<br>(0.0135) |
| Unemployment           | -0.0402<br>(0.0624)   |
| Constant               | 5.4128***<br>(0.6747) |
| R <sup>2</sup> within  | 0.4880                |
| R <sup>2</sup> between | 0.5523                |
| R <sup>2</sup> overall | 0.0168                |

Observations: 86.

Number of countries: 10.

Standard errors in parentheses:

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

The first correlation between asset ratio and GDP growth is positive and significant. This effect has the same implication as the positive and significant correlation between asset ratio and GDP growth in the overall correlation discussed in section 5.1. The same applies for the correlation between asset ratio and government debt, because in both panel regressions they are positive and significant.

However, the correlation between asset ratio and Unemployment in the panel regression of group two is negative but insignificant. This means that it cannot be excluded that the negative correlation is based on chance. Therefore it is not possible to make a solid claim about this correlation.

### 5.3.3 Group 3, Low asset ratio

In table 5, the results are shown of the third group, the group of member states with the bank capital to asset ratio below the 8% in all the observed years. The three independent variables are regressed with the asset ratio. The member states are: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Italy, Luxembourg, Netherlands, Spain, Sweden and the United Kingdom

Table 5: The regression of Group 3: low asset ratio, fixed effects

| Variables              |                       |
|------------------------|-----------------------|
| GDP growth             | 0.0260<br>(0.0313)    |
| Govern debt            | 0.0443***<br>(0.0112) |
| Unemployment           | -0.0758<br>(0.0614)   |
| Constant               | 3.3167***<br>(0.5353) |
| R <sup>2</sup> within  | 0.2103                |
| R <sup>2</sup> between | 0.0242                |
| R <sup>2</sup> overall | 0.0003                |

Observations: 116.

Number of countries: 13.

Standard errors in parentheses:

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

The correlation between asset ratio and GDP growth is positive but insignificant. Therefore, there can be made not valid statements about this correlation. The correlation between asset ratio and Unemployment is negative but insignificant, thus the same applies for the other insignificant correlation. The only positive and significant correlation is between asset ratio and government debt, what can indicates as explained in paragraph 5.1.1 a counter-cyclical interaction between the two variables.

### 5.3.4 Summarization of results of the three groups

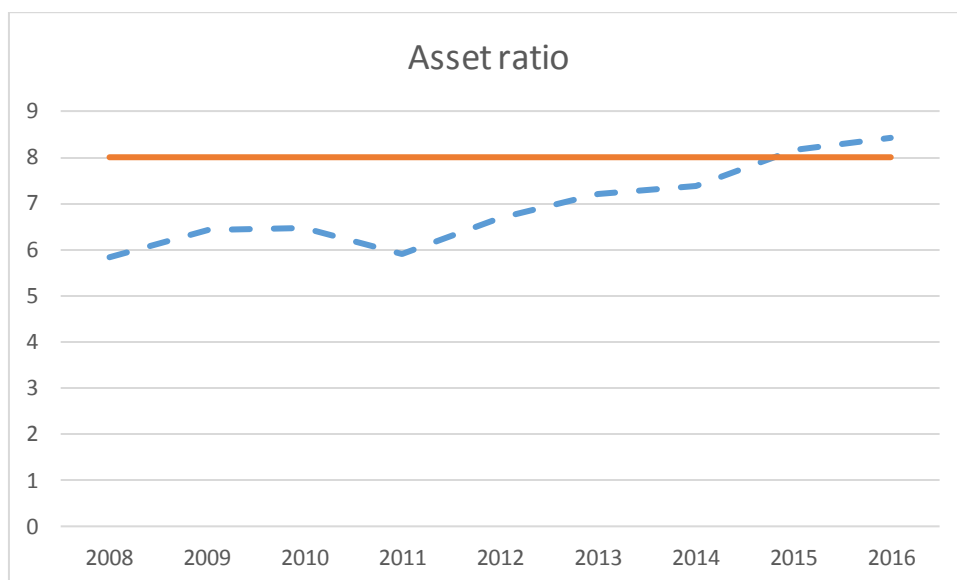
Looking at the results of the three groups, they all have a positive correlation between asset ratio and GDP growth. However, only in the medium group this correlation is significant. The correlation between asset ratio and government debt is in all three the groups positive and

significant. The correlation between asset ratio and Unemployment is in all three groups negative, it is however only in the high group significant. This negative correlation indicates positive economic growth and is therefore comparable with the positive correlation between asset ratio and GDP growth. Thus, the results are similar in the three groups if you look at whether the coefficient is positive or negative. However, the main difference lies in the level of significance between the results.

#### 5.4 Absolute convergence model

In figure 2, the development of the bank capital to asset ratio is shown. The straight line represents the 8% threshold set by the Capital Requirement Direction IV and the dashed line represents the average EU asset ratio. The average of the 28 EU member states is used to give a complete overview of the development in the recent period of observation. On the Y-axis, the percentage of bank capital to asset ratio is shown, and the years are on the X-axis.

Figure 2: Absolute convergence



The bank capital to asset ratio start increasing in 2011 until 2016. This is a year after Basel III agreement was published. From 2011 it steadily increases, in 2015 the 8% goal is reached, and in 2016 the bank capital to asset ratio is a little bit higher than 8% in the EU on average. To study if economic conditions are needed to move towards the 8% capital buffer, the absolute convergence model will be used. The dependent variable is the growth in bank capital to asset ratio from  $t$  to  $t+1$ . The independent variables will be the distance between the bank capital to asset ratio in  $t$  and the 8% threshold (asset ratio distance), and the economic circumstances in  $t$ .

The latter are the GDP growth, the government debt and the level of unemployment. To check for the time effect the results of the entire period of observation are showed. Furthermore, the data set is split up in three periods of three years, from 2008 until 2010, from 2011 until 2013 and from 2014 until 2016. This gives the opportunity to see how the interaction between the variables develop over the years. The results are represented in table 6.

Table 6: The regression of the asset ratio growth, fixed effects

|                        | 2008-<br>2016         | 2008-<br>2010          | 2011-<br>2013         | 2014-<br>2016          |
|------------------------|-----------------------|------------------------|-----------------------|------------------------|
| AssetRatioDistance     | 0.3100***<br>(0.0518) | 1.4840***<br>(0.2647)  | 0.6278***<br>(0.1311) | 0.6387***<br>(0.1651)  |
| GDP growth             | -0.0309*<br>(0.0160)  | -0.0324<br>(0.0235)    | -0.0296<br>(0.0475)   | -0.0083<br>(0.0450)    |
| Govern debt            | -0.0134**<br>(0.0067) | -0.0580**<br>(0.0221)  | -0.0206<br>(0.0184)   | 0.1155***<br>(0.0302)  |
| Unemployment           | 0.1280***<br>(0.0276) | 0.1011<br>(0.1206)     | 0.1870***<br>(0.0603) | 0.1691*<br>(0.0973)    |
| Constant               | 0.0170<br>(0.3662)    | 4.2172***<br>(-1.3284) | 0.1350<br>(-1.0191)   | -9.982***<br>(-2.1028) |
| R <sup>2</sup> within  | 0.2283                | 0.6434                 | 0.4684                | 0.4311                 |
| R <sup>2</sup> between | 0.0018                | 0.0445                 | 0.1280                | 0.1854                 |
| R <sup>2</sup> overall | 0.0165                | 0.0019                 | 0.0798                | 0.1005                 |
| N                      | 28                    | 28                     | 27                    | 26                     |

Standard errors in parentheses:

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

First, the correlation between the growth of the bank capital to asset ratio from t to t+1 (asset ratio growth) and the asset ratio distance is positive and significant between 2008 and 2016. This indicates that when the asset ratio distance increases with 1% point, the asset ratio growth increases with 0.31% point. In other words, the farther the country from the 8% threshold, the more quickly the asset ratio is growing. This can be called a “catching up” effect.

In the three different periods, the correlation between asset ratio growth and asset ratio distance is positive and significant. The most prominent “catching up” effect is between 2008 and 2010. The coefficient is 1.48. This is in the period the crisis started, before the new Basel III norm. The Basel III agreement was reached at the end of 2010 and needed to be implemented in 2013.

The economic circumstances GDP growth and government debt have a negative and significant correlation with the growth of the asset ratio between 2008 and 2016. This means

that when the government debt increases for example with 1% point, the asset ratio growth decreases with 0.01% point. The same principle applies for the correlation between GDP growth and asset ratio growth. Only the level of unemployment is positive and significant correlated with the asset ratio growth in the period between 2008 and 2016.

The correlation between government debt and the capital buffer growth is negative and significant between 2008 and 2010. This is the period where the financial crisis started. Because of the financial crisis, there were less tax revenues for the governments, which leads to an increase in government debt. The asset ratio decreases because of the economic downturn caused by the financial crisis. In times of economic downturns, there is less money available in the economy, which leads to a lower asset ratio.

However, the correlation between asset ratio growth and GDP growth is in all the three periods negative but insignificant. So explaining this negative effect is not possible. The correlation between asset ratio growth and government debt is between 2008-2010 and 2014-2016 negative and significant and between 2011-2013 negative but insignificant. The correlation with Unemployment is positive in all three periods, but insignificant between 2008 and 2010.

## 6. Discussion

In the next chapter, the results of the three groups and the convergence model will be discussed.

### 6.1 GDP growth

The correlation between asset ratio and GDP growth including all the EU member states is positive and significant. This shows that the asset ratio behaves counter-cyclically. When the economy is growing, the asset ratio increases. The higher asset ratio narrows the amount of money banks can lend.

Taking a closer look at the three groups, the correlation between asset ratio and GDP growth is only in the group with the medium asset ratio positive and significant. Thus, in the group with member states who have around the 8% asset ratio, the asset ratio behaves counter-cyclical. The GDP is growing and the asset ratio is increasing.

In the other two groups, the correlation between asset ratio and GDP growth is positive but insignificant. Therefore it is difficult to make interpretations about the two groups and cyclical behavior in the two groups. Furthermore, the insignificant results make it difficult to make interoperations for the three groups combined.

### 6.2 Government debt

There is a positive and significant correlation in the regression between asset ratio and government debt, which includes all the EU member states. This indicates that when the government debt is increasing, the asset ratio is also increasing. This occurs because when the government debt is increasing due to government expansions and/or tax cuts, there will be more money available and therefore the asset ratio increases. However, a government debt can also increase during an economic crisis because there are less tax revenues. The positive correlation between asset ratio and government debt means that even when the government debt increases due to lower tax revenues, the asset ratio is still increasing.

Observing the three different groups, it is interesting to see that all the groups have a positive and significant correlation between asset ratio and government debt. The increasing government debt means that there is more money available in the member states in each group and therefore the asset ratio increases.

### 6.3 Level of unemployment

The correlation between asset ratio and Unemployment is negative and significant in the regression with all the 28 EU member states. However, it is only significant at the level of  $p < 0.1$ .

The negative correlation means that in times when the level of unemployment increases, the asset ratio decreases. This means that the asset ratio behaves counter-cyclical, because when the level of unemployment increases, the economy is in downturn. A decreasing asset ratio can stimulate the bank lending. On the other hand, an increasing level of unemployment can also indicate that there is less money available in the economy due to an economic downturn and that there for the asset ratio decreases.

Observing the three individual groups, all three coefficients are negative, but only in the group with high asset ratio the correlation is significant. In the group with the high asset ratio, the negative correlation indicates that due to the increasing unemployment, there is less money available in the economy, which lead to a decreasing asset ratio. However, because of the insignificant results in the medium and low group, it appears that there cannot be made an analysis that applies for all the three groups.

#### *6.4 Convergence model*

As the results in table 6 show, there is in the whole period of observation, between 2008 and 2016, the distance of the asset ratio has a positive and significant effect on the growth of the asset ratio. This indicates a “catching up” effect. Because of the new capital requirements, countries with low asset ratio tries to increase their asset ratio to reach the 8% threshold. Thus, when the distance between the asset ratio and the 8% threshold increases, the asset ratio is growing from  $t$  to  $t+1$ . When the distance increases between the asset ratio of a member state and the 8% threshold, the reaction is that the asset ratio is growing to catch up with the 8% threshold.

For the economic circumstances between 2008 and 2016, all three have a significant effect. The negative and significant correlation between asset ratio and GDP growth indicates that when the GDP is growing, the asset ratio decreases. This indicates that in times of economic growth, the asset ratio growth is decreasing. In this way, the lower asset ratio stimulates the money lending into the economy. Nevertheless, the asset ratio behaves pro-cyclical, because the economy is growing. However, the correlation is at a low significance, only at  $p < 0.1$ . This is the lowest significance level, and therefore the result need to be analyzed with caution.

The correlation between asset ratio and government debt is negative and significant. This indicates that when the government debt is increasing, the asset ratio growth is decreasing. The government debt is increasing because of lower tax revenues. There is less money available in the economy and therefor the asset ratio growth is decreasing.

#### *6.4.1 Convergence model: between 2008 and 2010*

Between 2008 and 2010 the “catching up” effect is the strongest. This is the period when the financial crisis started. Thus, right after the financial crisis banks were increasing their asset ratio. This effect is the strongest in member states with banks who were far from the 8% asset ratio. They move more quickly toward the 8%. The other significant correlation in the period between 2008 and 2010 is between asset ratio growth and government debt. In this period, the government debt is increasing because of less tax revenues. Therefore there is less money available in the economy, which leads to a negative asset ratio growth.

#### *6.4.2 Convergence model: between 2011 and 2013*

The period between 2011 and 2013 is the first period that the Basel III norms were formed and implemented in the EU in the Capital Requirement Directive IV. The results show this “catching up” effect. There is a positive and significant effect between the asset ratio growth and the asset ratio distance. Thus, how far away the banks are from the 8% threshold, the faster they are growing their asset ratio to reach the 8% threshold, because of the new regulation.

In the period between 2011 and 2013 there is one other significant correlation, namely the positive and significant correlation between asset ratio growth and Unemployment. This indicates that when the Unemployment is increasing, the asset ratio growth is also increasing.

#### *6.4.3 Convergence model: between 2014 and 2016*

In the last period of observation, there is also a positive and significant effect between the asset ratio growth and the asset ratio distance. This shows the same “catching up” effect as discussed earlier. It continues furthermore after the Basel III agreement and the CRD IV that was implemented in 2013.

Furthermore, there is a positive and significant effect between asset ratio growth and the government debt. This indicates that when the government debt is increasing, there is more money available in the economy. This enables banks to increase their asset ratio to reach the 8% minimum threshold. Between 2014 and 2016 is also a positive and significant effect between asset ratio growth and Unemployment. However, the significance level is low, at  $p < 0.1$ .

## 7. Conclusion

In this conclusion, the four hypotheses will be discussed and whether they will be rejected or not. In the last section, the research question will be answered.

The first hypothesis was:

‘GDP growth is negatively correlated with bank capital to asset ratio.’

In the regression between GDP growth and asset ratio, which include all member states, there is a positive correlation between GDP growth and asset ratio. This means that the bank capital to asset ratio behaves counter-cyclical. When the economy is growing, the asset ratio is increasing. In this perspective, the capital buffers in the whole EU functions according to the Basel III agreement and the following Capital Requirement Directive IV. Taking a closer look to the three different groups the EU member states were divided in, only the second group, with the medium asset ratio, had a positive and significant correlation. The other two groups had a positive but insignificant relation with asset ratio.

However, the impact that GDP growth has on the asset ratio is not in line with the first hypothesis. There is a positive and significant correlation between the dependent variable and the GDP growth. This is in line with the counter-cyclical behavior of the capital buffers of the Basel III agreement. Thus, the growing GDP helps to increase the asset ratio.

The second hypothesis was:

‘Government debt is negatively correlated with bank capital to asset ratio.’

The overall correlation between asset ratio and government debt is positive and significant in the entire EU. This means that when the government debt increases, the asset ratio is also increasing. The increasing government debt can indicate an expansionary fiscal policy. When government debt increases, it can mean that a country is implementing an expansionary fiscal policy to stimulate the economy. On the other hand, it can indicate that in times of economic downturns, the tax revenues decrease and therefore the government debt increases. Whether the fiscal policy of a EU member state is pro or counter-cyclical depends on the economic development of that member state. The results showed that in the EU as a whole, the correlation between GDP growth and government debt is positive and significant. This indicates, when

looking at all the 28 member states in the EU, that an increasing government debt has a positive effect on GDP growth. This is in line with the attended cyclical behavior of the capital buffers.

Analyzing the three different groups of member states, they all have a positive and significant correlation. This means that the same conclusions can be taken from the correlation with all the 28 member states.

Studying the hypothesis again, in the EU as a whole there is a positive and significant correlation between government debt and bank capital to asset ratio. Furthermore, in the three groups is the overall correlation also positive and significant. This is not in line with the second hypothesis. Therefore, the second hypothesis will be rejected.

The third hypothesis was:

‘Unemployment is positively correlated with bank capital to asset ratio.’

The overall correlation between asset ratio and Unemployment is negative and significant. The bank capital to asset ratio functions according to the Basel III agreement and the CRDIV. When the level of unemployment is increasing, the economy suffers a setback. In order to stimulate the bank lending in the economy, the capital buffers should decrease. This is happening in the EU and therefore the bank capital to asset ratio functions counter-cyclical. Another possibility is that because of the increasing Unemployment, there is less money available in the economy due to an economic downturn. Therefore the asset ratio will decrease.

Looking at the three different groups, only the group with a high asset ratio has a negative and significant correlation between Unemployment and asset ratio. The other two groups have a negative but insignificant relation. The result of the regression of the high group is therefore comparable with the regression run with all the 28 member states. However, because the other two groups had an insignificant correlation, it is not possible to make indications that occurs for all the three groups combined.

The third hypothesis will be rejected. In the regression with all the EU member states, there is a negative and significant correlation. In the regressions between the three different groups, there is only a negative and significant correlation in the group with the high asset ratio. The causal mechanism behind this is a counter-cyclical policy, which is in line with Basel III and the EU CRDIV.

The last hypothesis was:

‘The distance between the bank capital to asset ratio and 8% is positively correlated with the growth of the bank capital to asset ratio.’

In the regression run between the distance of the asset ratio with 8% and the growth of the asset ratio, there was a positive and significant correlation. This means that when the distance of the asset ratio and 8% is increasing, the growth of the asset ratio is also increasing. Thus, member states with a bigger distance of their bank capital to asset ratio 8% will increase their bank capital to asset ratio to catch up. Thereafter, the data set was split up in three periods of three years. In all three periods, the correlation was positive and significant; therefore, the same principle occurs for these three periods.

The influence of the three different economic conditions on this process is more complicated. In the whole period of observation, the correlation between GDP growth and the growth of the asset ratio was negative and significant. In the three periods of three years, the relation was negative but insignificant. With government debt, the overall correlation was negative and significant, but in one period of three years, the correlation was insignificant. Between Unemployment and asset ratio growth, the overall correlation was positive and significant, but in one of the three periods, the coefficient was positive but insignificant. This makes it hard to determine the effect of the economic conditions on the growth of the bank capital to asset ratio.

However, because the correlation between the distance between the bank capital to asset ratio and 8%, and the growth of the bank capital to asset ratio is positive and significant. In the whole period of observation and the three periods of three years, the hypothesis will not be rejected.

The research question of this thesis was:

To what extent does the macro-economic situation in the EU member states influence their bank's capital buffers after the financial crisis of 2008?

Firstly, the macro-economic situation of the member states does influence the capital buffers of the member states. There is positive and significant effect between GDP growth and asset ratio.

There is also a positive and significant effect between government debt and asset ratio. Furthermore, there was a negative and significant effect between Unemployment and asset ratio.

The minimum capital threshold determined by the EU in the CRDIV has - as shown in this research – seems to have an effect on the bank capital to asset ratio. Possibly, banks also have other incentives to have a capital buffer above the minimum requirement. These are discussed in the background and theory section. Furthermore, the distance between the asset ratio has a positive and significant effect on the growth of the asset ratio. Which indicates that when the distance of the asset ratio and 8% increases, the bank capital to asset ratio is growing.

Over the whole EU, the macro-economic situation influences the capital buffers. In all three regressions, there is a significant effect, which indicates an impact of the macro-economic situation of the member states on the capital buffers.

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## APPENDIX

Table 7, the average bank capital to asset ratio (%) of the EU member states per year

| Country  | Year | Asset ratio | Country | Year | Asset ratio | Country         | Year | Asset ratio |
|----------|------|-------------|---------|------|-------------|-----------------|------|-------------|
| Austria  | 2008 | 6.284       | France  | 2011 | 4.754       | Malta           | 2014 | 7.228       |
| Austria  | 2009 | 6.977       | France  | 2012 | 5.201       | Malta           | 2015 | 7.313       |
| Austria  | 2010 | 7.493       | France  | 2013 | 5.818       | Malta           | 2016 | 7.511       |
| Austria  | 2011 | 7.186       | France  | 2014 | 5.282       | Netherlands     | 2008 | 3.219       |
| Austria  | 2012 | 7.77        | France  | 2015 | 5.794       | Netherlands     | 2009 | 4.315       |
| Austria  | 2013 | 7.986       | France  | 2016 | 5.941       | Netherlands     | 2010 | 4.433       |
| Austria  | 2014 | 6.842       | Germany | 2008 | 4.5         | Netherlands     | 2011 | 4.279       |
| Austria  | 2015 | 7.447       | Germany | 2009 | 4.8         | Netherlands     | 2012 | 4.693       |
| Austria  | 2016 | 7.334       | Germany | 2010 | 4.3         | Netherlands     | 2013 | 4.784       |
| Belgium  | 2008 | 3.281       | Germany | 2011 | 4.36        | Netherlands     | 2014 | 5.367       |
| Belgium  | 2009 | 4.628       | Germany | 2012 | 4.73        | Netherlands     | 2015 | 5.555       |
| Belgium  | 2010 | 4.965       | Germany | 2013 | 5.45        | Netherlands     | 2016 | 5.689       |
| Belgium  | 2011 | 4.6         | Germany | 2014 | 5.61        | Poland          | 2008 | 7.543       |
| Belgium  | 2012 | 5.761       | Germany | 2015 | 5.935       | Poland          | 2009 | 8.084       |
| Belgium  | 2013 | 6.39        | Germany | 2016 | 5.983       | Poland          | 2010 | 8.198       |
| Belgium  | 2014 | 6.627       | Greece  | 2008 | 5.674       | Poland          | 2011 | 7.818       |
| Belgium  | 2015 | 6.783       | Greece  | 2009 | 6.959       | Poland          | 2012 | 8.693       |
| Belgium  | 2016 | 7.053       | Greece  | 2010 | 6.665       | Poland          | 2013 | 9.098       |
| Bulgaria | 2008 | 11.4        | Greece  | 2011 | 5.731       | Poland          | 2014 | 8.938       |
| Bulgaria | 2009 | 10.84       | Greece  | 2012 | 5.758       | Poland          | 2015 | 9.37        |
| Bulgaria | 2010 | 10.47       | Greece  | 2013 | 7.548       | Poland          | 2016 | 9.507       |
| Bulgaria | 2011 | 10.76       | Greece  | 2014 | 8.062       | Portugal        | 2008 | 5.8         |
| Bulgaria | 2012 | 10.1        | Greece  | 2015 | 9.994       | Portugal        | 2009 | 6.494       |
| Bulgaria | 2013 | 10.35       | Greece  | 2016 | 10.7        | Portugal        | 2010 | 6.697       |
| Bulgaria | 2014 | 11.57       | Hungary | 2008 | 7.1         | Portugal        | 2011 | 5.327       |
| Bulgaria | 2015 | 12.02       | Hungary | 2009 | 7.6         | Portugal        | 2012 | 6.701       |
| Bulgaria | 2016 | 11.63       | Hungary | 2010 | 8.2         | Portugal        | 2013 | 6.921       |
| Croatia  | 2008 | 13.32       | Hungary | 2011 | 9.1         | Portugal        | 2014 | 7.66        |
| Croatia  | 2009 | 13.76       | Hungary | 2012 | 9.1         | Portugal        | 2015 | 8.441       |
| Croatia  | 2010 | 13.77       | Hungary | 2013 | -           | Portugal        | 2016 | 8.421       |
| Croatia  | 2011 | 13.56       | Hungary | 2014 | -           | Romania         | 2008 | 9.046       |
| Croatia  | 2012 | 14.22       | Hungary | 2015 | -           | Romania         | 2009 | 8.567       |
| Croatia  | 2013 | 13.89       | Hungary | 2016 | -           | Romania         | 2010 | 8.879       |
| Croatia  | 2014 | 14.04       | Ireland | 2008 | 3.746       | Romania         | 2011 | 8.072       |
| Croatia  | 2015 | 12.68       | Ireland | 2009 | 5.435       | Romania         | 2012 | 8.02        |
| Croatia  | 2016 | 14.04       | Ireland | 2010 | 5.323       | Romania         | 2013 | 7.957       |
| Cyprus   | 2008 | 6.9         | Ireland | 2011 | 6.44        | Romania         | 2014 | 7.384       |
| Cyprus   | 2009 | 4.907       | Ireland | 2012 | 7.279       | Romania         | 2015 | 8.178       |
| Cyprus   | 2010 | 6.118       | Ireland | 2013 | 7.749       | Romania         | 2016 | 8.924       |
| Cyprus   | 2011 | 5.295       | Ireland | 2014 | 12.7        | Slovak Republic | 2008 | 8.194       |

|                |      |       |            |      |       |                 |      |       |
|----------------|------|-------|------------|------|-------|-----------------|------|-------|
| Cyprus         | 2012 | 5.617 | Ireland    | 2015 | 13.97 | Slovak Republic | 2009 | 9.578 |
| Cyprus         | 2013 | 6.415 | Ireland    | 2016 | 13.53 | Slovak Republic | 2010 | 9.717 |
| Cyprus         | 2014 | 10.31 | Italy      | 2008 | 4.089 | Slovak Republic | 2011 | 10.75 |
| Cyprus         | 2015 | 10.11 | Italy      | 2009 | 4.816 | Slovak Republic | 2012 | 11.69 |
| Cyprus         | 2016 | 10.44 | Italy      | 2010 | 4.979 | Slovak Republic | 2013 | 12.12 |
| Czech Republic | 2008 | 5.46  | Italy      | 2011 | 5.448 | Slovak Republic | 2014 | 11.86 |
| Czech Republic | 2009 | 6.087 | Italy      | 2012 | 5.386 | Slovak Republic | 2015 | 11.12 |
| Czech Republic | 2010 | 6.486 | Italy      | 2013 | 5.404 | Slovak Republic | 2016 | 10.98 |
| Czech Republic | 2011 | 6.492 | Italy      | 2014 | 5.881 | Slovenia        | 2008 | 8.4   |
| Czech Republic | 2012 | 6.875 | Italy      | 2015 | 6.186 | Slovenia        | 2009 | 8.3   |
| Czech Republic | 2013 | 7.209 | Italy      | 2016 | 5.493 | Slovenia        | 2010 | 8.2   |
| Czech Republic | 2014 | 7.303 | Latvia     | 2008 | 7.747 | Slovenia        | 2011 | -     |
| Czech Republic | 2015 | 7.525 | Latvia     | 2009 | 7.701 | Slovenia        | 2012 | -     |
| Czech Republic | 2016 | 7.257 | Latvia     | 2010 | 9.274 | Slovenia        | 2013 | -     |
| Denmark        | 2008 | 5.516 | Latvia     | 2011 | 9.926 | Slovenia        | 2014 | -     |
| Denmark        | 2009 | 5.493 | Latvia     | 2012 | 10.48 | Slovenia        | 2015 | -     |
| Denmark        | 2010 | 5.432 | Latvia     | 2013 | 11.3  | Slovenia        | 2016 | -     |
| Denmark        | 2011 | 5.054 | Latvia     | 2014 | 10.07 | Spain           | 2008 | 5.865 |
| Denmark        | 2012 | 5.266 | Latvia     | 2015 | 10.06 | Spain           | 2009 | 6.418 |
| Denmark        | 2013 | 7.061 | Latvia     | 2016 | 9.955 | Spain           | 2010 | 6.095 |
| Denmark        | 2014 | 7.313 | Lithuania  | 2008 | 8.234 | Spain           | 2011 | 5.924 |
| Denmark        | 2015 | 7.791 | Lithuania  | 2009 | 7.306 | Spain           | 2012 | 5.757 |
| Denmark        | 2016 | 7.397 | Lithuania  | 2010 | 8.53  | Spain           | 2013 | 6.792 |
| Estonia        | 2008 | 8.236 | Lithuania  | 2011 | 10.78 | Spain           | 2014 | 7.242 |
| Estonia        | 2009 | 8.672 | Lithuania  | 2012 | 12.28 | Spain           | 2015 | 7.443 |
| Estonia        | 2010 | 9.282 | Lithuania  | 2013 | 12.62 | Spain           | 2016 | 7.789 |
| Estonia        | 2011 | 8.925 | Lithuania  | 2014 | 12.91 | Sweden          | 2008 | 4.7   |
| Estonia        | 2012 | 9.884 | Lithuania  | 2015 | 11.06 | Sweden          | 2009 | 5     |
| Estonia        | 2013 | 11.26 | Lithuania  | 2016 | 8.628 | Sweden          | 2010 | 4.7   |
| Estonia        | 2014 | 11.6  | Luxembourg | 2008 | 4.341 | Sweden          | 2011 | 4     |
| Estonia        | 2015 | 10.75 | Luxembourg | 2009 | 5.537 | Sweden          | 2012 | 4.2   |
| Estonia        | 2016 | 10.83 | Luxembourg | 2010 | 5.234 | Sweden          | 2013 | 4.4   |
| Finland        | 2008 | 6.238 | Luxembourg | 2011 | 4.998 | Sweden          | 2014 | 5.1   |
| Finland        | 2009 | 6.407 | Luxembourg | 2012 | 6.284 | Sweden          | 2015 | 5.6   |
| Finland        | 2010 | 5.525 | Luxembourg | 2013 | 6.392 | Sweden          | 2016 | -     |
| Finland        | 2011 | 4.354 | Luxembourg | 2014 | 6.496 | United Kingdom  | 2008 | 4.413 |

|         |      |       |            |      |       |                |      |       |
|---------|------|-------|------------|------|-------|----------------|------|-------|
| Finland | 2012 | 4.417 | Luxembourg | 2015 | 7.011 | United Kingdom | 2009 | 5.393 |
| Finland | 2013 | 5.011 | Luxembourg | 2016 | 7.356 | United Kingdom | 2010 | 5.366 |
| Finland | 2014 | 4.343 | Malta      | 2008 | 6.591 | United Kingdom | 2011 | 5.1   |
| Finland | 2015 | 5.602 | Malta      | 2009 | 7.201 | United Kingdom | 2012 | 5.509 |
| Finland | 2016 | 5.634 | Malta      | 2010 | 7.075 | United Kingdom | 2013 | 6.345 |
| France  | 2008 | 3.728 | Malta      | 2011 | 7.324 | United Kingdom | 2014 | 5.621 |
| France  | 2009 | 4.098 | Malta      | 2012 | 7.648 | United Kingdom | 2015 | 6.838 |
| France  | 2010 | 4.878 | Malta      | 2013 | 8.077 | United Kingdom | 2016 | 7.025 |

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Table 8: Asset ratio regressed with independent variables and member states as dummy variables, random effects

| Variables      | Model 1               | Model 2               | Model 3               |
|----------------|-----------------------|-----------------------|-----------------------|
| GDP growth     | 0.1597***<br>(0.0207) |                       |                       |
| Govern debt    |                       | 0.0407***<br>(0.0063) |                       |
| Unemployment   |                       |                       | 0.0630**<br>(0.0318)  |
| Countries:     |                       |                       |                       |
| Austria        | 1.5745***<br>(0.5410) | 1.4232**<br>(0.5597)  | 1.6232***<br>(0.6088) |
| Belgium        | -0.1354<br>(0.5410)   | -1.1526**<br>(0.5797) | -0.2427<br>(0.6079)   |
| Bulgaria       | 5.1759***<br>(0.5411) | 7.6837***<br>(0.6713) | 5.0929***<br>(0.6141) |
| Croatia        | 8.1552***<br>(0.5415) | 8.3570***<br>(0.5627) | 7.5269***<br>(0.6458) |
| Cyprus         | 1.8558***<br>(0.5419) | 1.5188***<br>(0.5596) | 1.3693**<br>(0.6189)  |
| Czech Republic | 0.9755*<br>(0.5410)   | 2.6236***<br>(0.6124) | 1.0540*<br>(0.6071)   |
| Denmark        | 0.6177<br>(0.5411)    | 2.0261***<br>(0.6056) | 0.5426<br>(0.6068)    |
| Estonia        | 4.3213***<br>(0.5412) | 7.0515***<br>(0.7116) | 4.0183***<br>(0.6138) |
| Finland        | -0.2406<br>(0.5416)   | 0.6198<br>(0.5835)    | -0.5438<br>(0.6084)   |
| France         | -0.6086<br>(0.5410)   | -1.0324*<br>(0.5621)  | -0.8561<br>(0.6132)   |
| Germany        | -0.6674<br>(0.5409)   | -0.4936<br>(0.5600)   | -0.6001<br>(0.6075)   |
| Greece         | 2.4102***<br>(0.5483) | -1.5464**<br>(0.7532) | 0.9196<br>(0.7290)    |
| Hungary        | 2.8087***<br>(0.6414) | 2.5359***<br>(0.6620) | 2.2676***<br>(0.7263) |
| Ireland        | 2.2407***<br>(0.5446) | 2.3284***<br>(0.5628) | 2.3897***<br>(0.6304) |
| Italy          | -0.1491<br>(0.5422)   | -2.197***<br>(0.6219) | -0.6439<br>(0.6157)   |

|                        |                       |                       |                       |
|------------------------|-----------------------|-----------------------|-----------------------|
| Latvia                 | 4.0803***<br>(0.5416) | 5.5186***<br>(0.6140) | 3.4778***<br>(0.6398) |
| Lithuania              | 4.5066***<br>(0.5409) | 6.2747***<br>(0.6212) | 4.2110***<br>(0.6272) |
| Luxembourg             | 0.0950<br>(0.5412)    | 2.5960***<br>(0.6684) | 0.3068<br>(0.6081)    |
| Malta                  | 1.1143**<br>(0.5445)  | 2.1336***<br>(0.5656) | 1.6364***<br>(0.6071) |
| Netherlands            | -0.9633*<br>(0.5410)  | -0.3803<br>(0.5684)   | -0.9663<br>(0.6076)   |
| Poland                 | 2.5063***<br>(0.5428) | 3.9202***<br>(0.5834) | 2.7296***<br>(0.6097) |
| Portugal               | 1.4344***<br>(0.5418) | -0.1618<br>(0.5979)   | 0.8287<br>(0.6358)    |
| Romania                | 2.4456***<br>(0.5413) | 4.4714***<br>(0.6295) | 2.6087***<br>(0.6067) |
| Slovak Republic        | 4.7234***<br>(0.5416) | 6.2459***<br>(0.5950) | 4.5700***<br>(0.6338) |
| Slovenia               | 2.9079***<br>(0.7663) | 4.4649***<br>(0.8438) | 2.6207***<br>(0.8585) |
| Spain                  | 1.0237*<br>(0.5414)   | 0.8704<br>(0.5594)    | -0.0318<br>(0.7546)   |
| Sweden                 | -1.0729*<br>(0.5576)  | 0.5141<br>(0.6235)    | -1.0870*<br>(0.6263)  |
| United Kingdom         | -                     | -                     | -                     |
| Constant               | 5.5678***<br>(0.3831) | 2.5504***<br>(0.6310) | 5.3095***<br>(0.4797) |
| R <sup>2</sup> within  | 0.2195                | 0.1652                | 0.0182                |
| R <sup>2</sup> between | 1.0000                | 1.0000                | 1.0000                |
| R <sup>2</sup> overall | 0.8185                | 0.8058                | 0.7716                |

Observations: 241.

Number of countries: 28.

Standard errors in parentheses:

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 9: GDP growth regressed with government debt and the member states as dummy variables, random effects

| Variables      |                            |
|----------------|----------------------------|
| Govern debt    | 0.0392**<br>(0.0187)       |
| Austria        | -0.4184<br>(-1.7568)       |
| Belgium        | -1.1586<br>(-1.8136)       |
| Bulgaria       | 2.9709<br>(-2.0754)        |
| Croatia        | -0.8116<br>(-1.7655)       |
| Cyprus         | -1.6221<br>(-1.7568)       |
| Czech Republic | 1.7666<br>(-1.9069)        |
| Denmark        | 0.8586<br>(-1.8874)        |
| Estonia        | 20.004<br>(-2.1916)        |
| Finland        | -0.2993<br>(-1.8244)       |
| France         | -0.7843<br>(-1.7637)       |
| Germany        | 0.2050<br>(-1.7579)        |
| Greece         | -<br>7.469***<br>(-2.3116) |
| Hungary        | -0.1809<br>(-1.7567)       |
| Ireland        | 2.6700<br>(-1.7659)        |
| Italy          | -3.4956*<br>(-1.9340)      |
| Latvia         | 0.3234<br>(-1.9113)        |
| Lithuania      | 1.8069<br>(-1.9318)        |
| Luxembourg     | 3.1053<br>(-2.0672)        |
| Malta          | 3.5299**<br>(-1.7736)      |
| Netherlands    | 0.2045<br>(-1.7816)        |

|                        |           |
|------------------------|-----------|
| Poland                 | 3.1768*   |
|                        | (-1.8241) |
| Portugal               | -2.7507   |
|                        | (-1.8655) |
| Romania                | 2.7791    |
|                        | (-1.9556) |
| Slovak<br>Republic     | 2.5763    |
|                        | (-18.573) |
| Slovenia               | 0.0279    |
|                        | (-1.8038) |
| Spain                  | -1.0314   |
|                        | (-1.7563) |
| Sweden                 | 1.9950    |
|                        | (-1.8919) |
| United<br>Kingdom      | -         |
| Constant               | -2.0233   |
|                        | (-1.9207) |
| R <sup>2</sup> within  | 0.0193    |
| R <sup>2</sup> between | 1.0000    |
| R <sup>2</sup> overall | 0.1639    |

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Observations: 252.

Number of countries: 28.

Standard errors in parentheses:

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1.