INSTITUTO POLITÉCNICO DE LISBOA
INSTITUTO SUPERIOR DE CONTABILIDADE E ADMINISTRAÇÃO DE LISBOA

THE IMPACT OF THE BASEL ACCORDS IN LENDING ACTIVITY:

THE CASE OF PORTUGAL AND GERMANY

Ana Rita Teixeira Borges Sabino

Lisboa, Julho de 2017

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Dissertação submetida ao Instituto Superior de Contabilidade e Administração de Lisboa para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Contabilidade e Análise Financeira, realizada sob a orientação científica do Professor Doutor Joaquim Paulo Viegas Ferreira de Carvalho.

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Abstract

The impact of the Basel Accords implementation in lending availability is approached in this dissertation. Based in Naceur and Kandil (2013) models, the Portuguese and the German banking sectors are assessed, having in mind the main question: did the Basel Accords implementation reduced lending availability? Our findings show that lending was reduced after implementation of the Basel Accords but also due to macroeconomic conditions. However, some limitations in this study are found in the end of the analysis.

Resumo

O impacto da implementação dos Acordos de Basileia no acesso ao crédito é o tema abordado nesta dissertação. Com base nos modelos de Naceur e Kandil (2013), o sector bancário português e alemão são analisados, tendo em conta a questão fundamental: o acesso ao crédito foi reduzido devido a implementação dos Acordos de Basileia? Os resultados mostram que o crédito diminui depois da implementação dos Acordos de Basileia mas também devido às condições macroeconómicas. No entanto, são encontradas algumas limitações no estudo, no fim a análise.

Table of Contents

Index of Tables

Index of Figures

Acronyms

BIS - Bank for International Settlements

BCBS - Basel Committee on Banking Supervision

ECB - European Central Bank

MFI - Monetary Financial Institution

EU - European Union

TD/TA ratio - Total Debt to Total Assets Ratio

TA/E ratio - Total Assets to Equity Ratio

E/A ratio – Equity to Asset Ratio

E/D ratio – Equity to Debt Ratio

GS/TA ratio – Government Securities to Total Assets Ratio

TA/E ratio - Total Assets to Equity Ratio

E/TA ratio – Equity to Total Assets Ratio

DIFcomp -Differential between loan interest rates and deposit interest rates pertaining to corporations

DIFhouse -Differential between loan interest rates and deposit interest rates pertaining to households

PT – Portugal

DE - Germany

MCR - Minimum capital requirements

MGS - Mutual Guarantee Societies

RWA - Risk weight assets

VAR - Value-at-Risk

LR - Leverage ratio

LCR - Liquidity Coverage ratio

NSFR - Net Stable Funding ratio

BdP - Banco de Portugal

ECB – European Central Bank

ESCB - European System of Central Banks

SDW - Statistical Data Warehouse

GDP – Gross domestic product

1. Introduction

Studies continue to growth regarding the consequences of the Basel Accords implementation on the financial sector and the worldwide economy. Rooted on the aims to contribute to economic stability and fair competition amongst financial institutions, the Basel Accords have been systematically examined in detail since the 80s.

Concerns are focused on knowing if, in fact, the regulation, as presented in the Basel Accords and adapted by the EU in its directive, has been contributing to financial stability and economic growth. However, one of the major vague of critics on the Basel Accords arouse as a consequence of the 2008 crisis, because four years before the Basel II Accord had been released: how can a worldwide financial crisis happen, if four years before capital regulation had been improved and implemented to strengthen banks?

In 2010, the Basel III Accord was released and, again, new studies have been developed in order to assess if regulation is providing an effective response to the challenges inherent to the financial system. These studies have been covering a wide range of topics that are addressed by the Basel Accords and to which banking regulation defines frameworks and guidelines. Topics such as lending, liquidity and capital are frequently revisited by the Basel Committee, which has in mind the necessary adjustments of regulation in order to meet the demands of financial stability challenges.

In such context, this study starts with an overview on the banking sector need for regulation, and how Basel has been responding to this need since the 80s. After a summarized description of the several Basel Accords and their main changes on the covered topics, a review will be presented on the literature focusing the Basel III Accord and its impact in lending.

In a nutshell, the aim is to provide a critic literature review on the subject of lending and how its supply and cost have been impacted due to the minimum capital requirements (MCR) established by the Basel Accords. In other words, when banks are obliged to meet minimum capital requirements, do they cut on lending supply to customers or overcharge lending availability, in order to present desirable capital adequacy ratio?

A wide number of studies have been presented to the academic and professional communities on this subject. Usually, in both theoretical and empirical research, one can find antagonistic results: in one hand, some studies reject the possibility of a direct link between minimum capital requirements and a negative impact on lending, assigning this responsibility to macroeconomic conditions; on the other hand, other studies point out how harmful regulation can be in shrinking available lending and how this can slowdown economic growth itself.

In our empirical study, data was gathered since 2000 until 2016, regarding the banking system in Portugal and Germany, with the aim of testing whether the implementation of the Basel Accords lead to a different behaviour of the banking portfolios and, if so, to what extent they were the accountable for lending shrinkage.

We base our empirical study in the models developed by Naceur and Kandil (2013), and the results show that both Portugal and Germany revealed a decrease of loan granting due to the Basel Accords implementation.

2. Literature Review

2.1. The Roots of the Basel Accords and the need for regulation

The foundation of the Bank for International Settlements (BIS) happened on the 30s, in Switzerland, and its members were central banks and monetary authorities. BIS was created in order to promote cooperation between central banks, which lead to its role as a key player in international banking discussions and decision making.

The 70s, a period of financial instability due to the emergence of floating exchange rates, high inflation and acute growth of the financial markets which led to some financial constraints, showed how regulation was needed, especially pertaining to international banks activities. Therefore, the Basel Committee on Banking Supervision (BCBS) was created within BIS, and the G10 central banks Governors started the task of uniting efforts to avoid financial distress both at the local and global levels.

The stability and the soundness of the financial systems have been the targets of BCBS, in particular, and of regulation in general. The BCBS does not have the authority to force countries to follow its guidelines, however its recommendations have been adapted by the European Union into Directives, and regulation based on the Basel Accords is followed not only by the EU members but also worldwide. According to Schwarcz (2008, p. 246), "approximately one hundred countries have signalled that they will implement Basel II by 2010". The author also mentions how successful the BCBS has been in presenting a single regulatory scheme for financial risk that is adopted and applied across diverse national financial systems.

Furthermore, the worldwide adoption of the Basel Accords is linked to the need of regulation. But why is regulation needed? Santos (2001) refers that regulation is important to avoid systemic risk and to avoid negative consequences due to the inability of depositors to supervise banks. In a more wide perspective, regulation is needed, especially for banks, because systemic risk must be avoided: financial distress in a bank can start a chain of distress and financial instability in a country damaging its own economy and then contaminating other countries' economies as well.

Schwarcz (2008) also points out that regulation is considered the way to maximize economic efficiency. He goes even beyond, arguing that systemic risk can have repercussions beyond the financial system and, therefore, regulation can have an impact on other society systems: “Failure of the financial system can generate social costs in the form of widespread poverty and unemployment, which in turn can destroy lives and foster crime” (Schwarcz 2008, p.207).

The author observes that definitions of systemic risk in the literature are inconsistent, because in some cases they refer to a succession of losses along a chain of institutions; in other cases to the volatility of asset prices, corporate liquidity reduction and potential bankruptcy; and in some other cases to default by one market participant. The only common point is that there is a trigger event that causes a negative chain of economic consequences (Schwarcz 2008). In his opinion, institutional systemic risk and market systemic risk should not be isolated from each other. Banks or other financial institutions failure can lead in a chained way to deprivation of capital by society. In this sense, the classical example of systemic risk is a bank run, or the failure of a bank to respond to a high number of withdrawal-demands, leading to its failure and, through a domino effect, to other banks failure (Bhattacharya and Thakor 1993). This example, as well as participant default, will lead to consequences in the market, thus systemic risk cannot be analysed without both the institutional and the market layers (Schwarcz 2008).

Besides avoiding systemic risk, such as the example of a bank run or financial panics, regulation can also minimize the asymmetry of information regarding risks involved in financial transactions towards markets participants. In this perspective, when Santos (2008) refers the above mentioned difficult of depositors in supervising banks initiatives, regulation is meant to bring to the scene experts on regulation – the regulators – who compromise to this role and task.

Therefore, market discipline is another aspect of regulation, because it promulgates information transparency and promotion of incentives for those who participate in decision-making on investments to avoid too risky investments that can generate acute losses. It also can contribute to determine limits on banks decision, by disciplining them in terms of limiting exposure (inter-institutional exposure) and leverage and making sure liquidity is possible (Schwarcz 2008).

In this context, the Basel Accords have been playing a central role in terms of market discipline, since capital adequacy determines that a minimum level of capital should be held by banks in order to minimize risks and create a buffer against financial distress originated, for example, by too high leverage. Also, the Basel Accords have been contributing to information transparency and to awareness on risk management.

2.2. The Basel Accords frameworks and topic changes during time

2.2.1. The Basel I Accord

In 1988, after several years of work to ensure international convergence on supervisory regulations, the BCBS released the first Basel Accord, named at the time: Capital Measurement and Capital Standards (BCBS, 1988). The two main objectives for this Accord to be released were to provide a framework to strengthen the soundness and stability of the international banking system and to ensure fairness and consistency in order to avoid the possibility of competitive inequalities amongst international banks (BCBS, 1999).

In this perspective, two main central pillars were developed and remained central in all Basel Accords. On the one hand, the definition of minimum capital requirements (MCR) as a buffer to possible losses; on the other hand, the risk weight assets (RWA) as the way to measure risk and therefore what buffer should be consistent with the assigned risk. BCBS (1988, p.2) summarizes: “Much also depends on the quality of a bank's assets and, importantly, the level of provisions a bank may be holding outside its capital against assets of doubtful value”.

Capital is then distinguished into two main categories:

1) Core Capital or Tier 1: equity capital; disclosed reserves.
2) Supplementary Capital or Tier II: undisclosed reserves; revaluation reserves; general provisions/general loan-loss reserves; subordinated term debt; hybrid debt capital instruments.

The RWA is presented in the context of credit risk that the BSBC relates, not exclusively but essentially, to counterparty default. Therefore,

> «a weighted risk ratio in which capital is related to different categories of asset or off-balance-sheet exposure, weighted according to broad categories of relative riskiness, is the preferred method for assessing the capital adequacy of banks (BSBC, 1988, p.8)»

Consequently, assets are attributed a risk weight depending on their category and quality (for example, cash is risk weighted at 0% due to its immediate liquidity) and the relation between capital to risk weight assets should not be under 8%.

Figure 1: Cooke Ratio

$$\text{Total Capital Ratio} = \frac{\text{Total Capital}}{\text{Risk} - \text{weighted assets}}$$

In 1995, the BCBS released an amendment to the previous Basel Accord, raising awareness to the importance of including market risk in capital adequacy, therefore focusing the risk emerging from foreign exchange and interest rates, as well as equity positions and commodities risk (BCBS, 1996, 2005).

Two broad methodologies to measure market risk were presented, from which one should be chosen and approved by the national authorities. The standard approach weights the risk of open positions, foreign exchange, counterparty default, liquidity and commodities, adding the resulting figure to the sum of risk-weighted assets compiled for credit risk purposes (BCBS, 2005). The second approach allows banks to use internal models to measure market risk, such as the Value-at-Risk (VAR) methodology, for example by taking into account the historical value of a position and measuring risk as the 1% confidence level of the distribution of 10-day trading losses.

Besides providing guidelines to regulation, the BCBS also assesses in a regular basis the impact of its guidelines in the real world of banking industry. As a result, amongst other topics, the impact of the Basel guidelines on lending activities has been focused by the BCBS (1999, 2010). In these studies, BCBS analysed if capital requirements had diminished risk-taking and if, in order to raise capital, banks decreased their lending availability. From an early stage, it is in fact reported that capital ratios increased and are related to a combination of wider lending spreads and reduced lending volumes (MAG, 2010). Such as the other topics, the BCBS affirms it is important to develop more studies on the impacts and literature focusing lending.

2.2.2. The Basel II Accord

In 2004, as a result of critics, changes over time in the banking industry and assessments on the previous Basel Accord on its limitations and consequences, the BCBS released the Basel II Accord (BCBS, 2004). One of the main changes is the definition of capital adequacy based on three pillars: 1) minimum regulatory capital requirements; 2) supervisory review to capital adequacy; 3) market discipline and disclosure.

The first pillar focuses the need of capital adequacy regarding credit risk, market risk and operational risk. The latter was for the first time included and considered important in terms of risk: from an operational perspective, there is also vulnerability that can lead to potential financial losses. Also, capital requirements for credit risk suffered a major change, in terms of measurement: banks were given the option to choose between three methodologies. Adding to the standard methodology, in which ratings provided by rating agencies were considered, banks could choose instead internal based models (IRB foundation and IRB advanced).

The second pillar prompts the importance of the active role that banks need to have, in terms of risk management, and regulators as well. The BCBS underlines that banks should assess capital, define capital targets consistent with their risk profile. On another perspective, regulators are expected to monitor banks regarding risk management and to intervene in case capital needs are neglected (BCBS, 2004).

The third pillar promulgates that disclosure is essential to market discipline. In this point, the BCBS promotes the importance of banks disclosing pertinent information on risk assessment processes and capital adequacy in order to ensure supervisory review and to mitigate issues due to asymmetry of information.

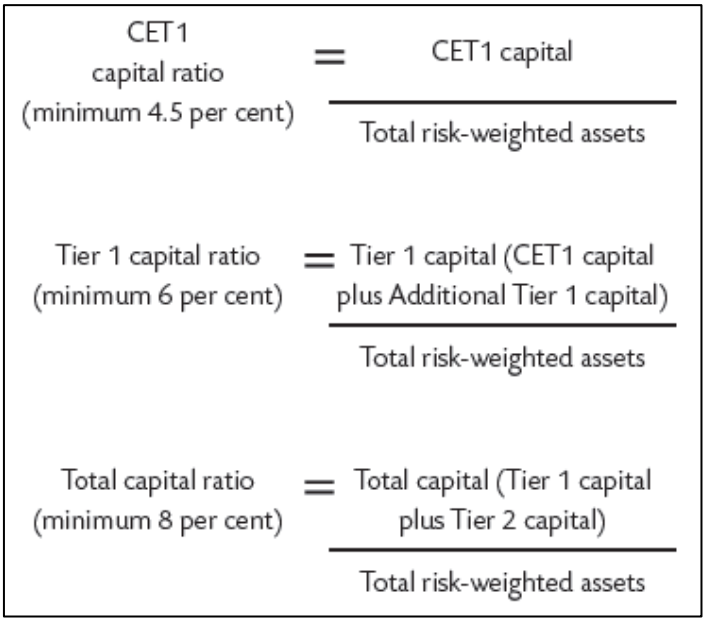
Although Basel II Accord showed several improvements when compared to the previous Basel Accord, it was not without much criticism it was approached, especially after 2007, when the world faced one of the largest financial crisis ever.

2.2.3. The Basel III Accord

In 2010, as a consequence of the critical times the world was going through due to the 2008 financial crisis, the BCBS quickly tried to respond to the worldwide situation, by issuing a new framework for banking regulation: the Basel III Accord (BCBS 2010, 2011).

Several changes were applied in this framework with the aim of strengthening the capital adequacy of banks, ensuring more liquidity and decreasing leverage. Capital quality and ratios to be held were increased. For example, common equity Tier I, the capital considered of much quality (common shares and retained earnings), is now required to be held at 4.5%, instead of 2%.

Figure 2: Capital Adequacy Ratio



Source: Australian Prudential Regulation Authority
http://www.apra.gov.au/Submissions/Pages/14_01.aspx

Also, more accuracy was required to be applied when measuring how risky assets are and more weight was attributed, for example, to the risk of counterparty default.

Furthermore, buffers were established: the capital conservation buffer, intended to absorb possible losses, should be held at 2.5% of RWA; and the countercyclical buffer was increased so that "the banking sector serves as a shock absorber, instead of a transmitter of risk to the financial system and broader economy" (BCBS, 2011, p.5).

Additionally, 3 ratios were established by the Accord: the Leverage ratio (LR), the Liquidity Coverage ratio (LCR) and the Net Stable Funding ratio (NSFR). The LR should not be under 3% and takes into account the available principal capital in relation to the consolidated assets. The higher this ratio, the higher the probability of a bank to resist to financial distress due to limited leverage dependency. The LCR promulgates the need for banks to hold enough liquid assets to cover the total net cash flow for over 30 days, ensuring liquidity and solvability. Finally, the NSFR focuses the need to ensure long-term funding and thus long-term banks resilience, by calculating long-term assets in relation to long-term and stable funding sources.

Since 2010, several changes have been made to the Basel III Accord and BIS has been presenting several discussion papers and enhanced frameworks. There are already rumours concerning the issuance of the Basel IV Accord, but for now BIS advises that all improvements pertain to the Basel III Accord reforms.

2.3. The Basel Accords regulation and their impact in lending

While reading about the above topic, it was easily understood that unanimity is far from being achieved in relation to this topic. Part of the researchers proclaim that regulation is not the responsible for loan supply contraction and that macroeconomic conditions are the ones contributing to credit crunches and economic development slowdown; other researchers defend the opposite, showing that after the implementation of the Basel Accords and, especially due to MCR, banks chose to shrink their lending supply intentionally in order to meet the capital requirements defined as a target to banks.

The first question is to identify if banks, in order to comply with the MCR and adjust their capital adequacy ratio, increase in fact their capital or replace riskier assets by less riskier assets (BIS, 1999). Several authors present evidence in terms of the effectiveness of the regulation coming from the Basel accords: Calem and Rob (1996) as well as Jacques and Nigro (1997) show how us banks in the 80s and 90s apply regulation through risk allocation in banks' portfolios: by allocating assets based on their risk, banks manage to comply with the capital adequacy ratio. Berger and Udell (1994, p. 624) also present evidence in the same way, concluding that "the increase during the early 90s and over the 1980s in the flow from loans to securities can give evidence on the existence of a credit crunch": also, Peek and Rosengren (1995) and Brinkmann and Horvitz (1995) point out that the credit crunch in the USA during 1990-1992 was motivated by more stringent capital rules.

The second question is related to the direct link between capital requirements and credit supply. A considerable number of studies develop this topic from a theoretical point of view. For example, Myers and Majluf (1984) review the theoretical underpinnings of the relation between capital regulation and its impact in credit supply and show that in case banks are unable to comply with MCR they chose to shrink credit supply.

Several other authors can be identified in this theoretical approach however stating the opposite from Myers and Majluf (1984). For example, Hellwig (2010) and Hellwig et al. (2013) present severe critics to the Basel Accords such as the lack of a critical

approach to the Basel II Accord by the BIS and its failure regarding the financial crisis that erupted 3-4 years after this Basel Accord was published.

Regarding the topic of lending contraction due to Basel regulation, Hellwig (2010) states that, in the same way that other topics are incorrectly understood, the lending topic is also mistakenly approached. The author states that fallacies are undertaken when this topic is approached and, instead of thinking of the after crisis credit crunch as a consequence of too much capital (as a constrain originated by the MCR), the credit crunch should be understood as a consequence of too little capital: "credit crunches arise when banks are undercapitalized and if banks have sufficient equity capital, they will have no reason to pass up economically valuable lending opportunities and the risk of credit crunch is reduced" (Hellwig et al., 2013, p. 48).

From this argument, Hellwig goes on acknowledging that, in fact, reducing loans in the balance sheet is a general reaction to higher capital requirements. He defends however that there are other financial strategies that can lead to meet to the capital adequacy ratio without reducing loans supply: for example, a bank can recapitalize by issuing new capital and use the proceeds to buy back debt or buy securities.

In a nutshell, Hellwig (2010) supports that saying that MCR demanded by regulation led to a credit crunch is a fallacy, resulting from a misunderstanding on the potential funding combinations that banks can optimize in their balance sheets. Also, this means neglecting the fact that more capital will always mean stronger banks and those were able to maintain lending during the crisis as usual (Kapan & Minoiu, 2013).
As interesting as it can be, the theoretical approach meant always a limitation on our study. For example, Hellwig (2010, 2013) statements could be found pertinent in this topic, but the lack of an empirical case to corroborate his views were not in line with our study aims.

Regarding the empirical approach to his topic, Nicolo (2015) reviewed the studies done in the aftermath of the 2007-2009 crisis until 2015, focusing the models that were used on these studies. Nicolo's intention is to understand why initially the estimated impact of MCR in lending contraction was lower that the impacts that are nowadays calibrated between MCR and lending supply, concluding that the negative impact of MCR in lending is significantly larger than previously thought.

In fact, in the 80s and 90s much of the literature shows little impact of capital regulation in the actual capital ratios of banks. BIS (1999) reviewed research done in this sense and, based on authors such as Shrieves and Dahl (1992), Jacques and Nigro (1997), Wall and Peterson (1987, 1995) amongst many others, affirm that there was little evidence of capital regulation impact on banks ratios.

Globally, other authors argue in the same sense: Barajas, Chami and Cosimano (2005) assessed the impact of the Basel Accord I in Latin America and suggested that there was little evidence that regulation had an impact in banks, especially a negative impact in loans supply. Barrios and Blanco (2003), focusing commercial banks in Spain between 1985 and 1991, also showed results suggesting that there were no major constraints in banks due to capital regulation. In the MENA region, Naceur and Kandil (2013) gathered data from 5 different countries (Egypt, Jordan, Lebanon, Morocco and Tunisia), and presented that major changes in banking portfolios and lending behaviour were linked to macroeconomic conditions rather than the Basel Accords implementation. Peek and Rosengren (1995) found however that macroeconomic conditions, responsible for lowering loan demand, and MCR both contributed together to a decrease in lending in New England.

Furthermore, in Japan this topic is also focused: Kim and Moreno (1994) suggest that due to regulation banks in Japan decreased their credit availability. Ito and Sasaki (1998) assessed smaller banks and, in the same way, identified a tendency to cut lending availability, contributing to a contraction in the national lending growth (Woo, 1999).
Also, Allen et al. (2012) defend that there is a real danger that regulatory reforms will limit credit availability and reduce economic activity: "the authorities must use the long period of Basel III implementation to engage both banks and investors in constructive dialogue about the required operational and business changes. If these are not

forthcoming, then the cure will indeed turn out to have been worse than the disease" (Allen et al. 2012, p. 1). In other words, long run economic growth will be negatively impacted if borrowers, such as SMEs, are denied lending as a consequence of capital regulation.

Gavalas (2015) focus European banks and acknowledge that, due to MCR, banks' marginal cost of funding increased, thus leading to higher lending rates. The author warns to how carefully regulation needs to be defined and implemented, having in mind these consequences. Cosimano and Hakura (2011) also study the impact of the Basel III Accord in lending rates by developing a cross-country analysis. They say that the response to regulation varies from one advanced economy to another, however, in general, lending rates always increased, contributing to loan growth decrease.

In the USA, Barajas et al. (2010) show evidence that, during the period 2007-2009, US banks went through a slowdown of lending, because in order to increase capital and profit margins they cut lending availability.

3. Formulation of Hypothesis

Based on the above literature review, which shows that there is no unanimity on the determinants on banking lending decrease, two hypotheses are formulated and tested in the study.

As previously mentioned the Basel Accords established that assets are assigned a risk weight and banks should hold a percentage of capital against possible losses, the total risk-weighted assets (Berger & Udell, 1994). Because it is expensive to raise capital, a possible consequence of the MCR is that banks can substitute their assets into less riskier ones. Instead of increasing capital or improving its quality, banks can replace their assets by removing the risky ones (such as commercial loans) and purchasing less risky ones (such as Treasuries). This enables banks to be compliant with the percentages required by Basel and the regulation authorities, by ensuring capital adequacy in regards to RWA and, at the same time, avoiding raising expensive capital (Berger & Udell, 1994).

According to Avery and Berger (1991), more than one-fifth of banks in the US were faced with this situation, since they were below the minimum regulatory capital. Also, in the 90s, the US showed a reduction on commercial loans and increase on holdings of Treasuries, which was consistent with the predictions on this consequence of the MCR.

The main issue arising from the consequence of the implementation of MCR is that, by replacing riskier assets such as commercial loans by less risky assets, banks decrease their supply of credit, and borrowers, who previously would be able to borrow, are denied loans or requested to pay higher loan interest rates than before the MCR implementation. Consequently, loan supply decreases would lead to a credit crunch and to a significant reduction in the macroeconomic activity (Breeden & Isaac, 1992; Wojnilower, 1992; Haubrich & Wachtel, 1993; Thakor, 1993).

Therefore, the first assessment done in this study is to understand if, due to the Basel Accords, there were changes in the banking portfolio behaviour, in order to comply to the MCR. This first assessment is framed by the following hypothesis:

Hypothesis 1: Did the Basel Accords implementation lead to changes in the banking portfolio behaviour?

The second assessment is based on Berger and Udell (1994) risk-retrenchment hypothesis and refers to an intentional loan contraction or decrease of loan supply by the banking systems in order to diminish risk underlined by the MCR. In this case, loan growth rates will present variations between the pre- and post-Basel periods as a consequence of the perception of risk and the intention to decrease vulnerability to it by complying with MCR.

Contrarily, Naceur and Kandil (2013) also draw attention to the fact that variations on loans growth rate can be instead linked to demand-side perspective. In this case, a decrease of loans would be a result of macroeconomic conditions in which individuals and companies diminish investment, rather than a result of specific actions taken in asset portfolio management by banks, in order to meet MCR.

Based on the above, the second hypothesis included in this study is the following:

Hypothesis 2: Did the Basel Accords implementation lead to loan supply contraction from banks?

4. Data and Measures

Data collection was put in place to cover the range period when the Basel II and III Accords were issued and implemented regarding two countries: Portugal and Germany. The process of implementation of the Basel III Accord was extended until 2019 and data was collected until 2016. Although this study does not comprise the full implementation period, its issuance happened in 2010 and 2011, providing already a pertinent time frame to assess regulation impacts, considering that we gathered data from 2000 until 2016. Thus, the data sample in this study was selected having in mind this limitation. However, this limitation was not found to be inconsistent with the determination that a period of 4, 5 years after the publication of the Basel Accords is sufficient to provide valid conclusions regarding the impacts of the Basel Accords in the banking systems.

4.1. Sample Description

Data were collected mainly from the Statistical Data Warehouse (SDW) of the European Central Bank (ECB), but also from the Banco de Portugal (BdP).

The sample used in this study presents data pertaining to the Portuguese and the German banking systems, since 2000 until October 2016. The specific data items collected from the above databases were defined based on Naceur and Kandil (2013). Therefore, data was collected having in mind the calculation of ratios and growth rates, which were used as variables of the two models presented by the authors.

One of the aims in terms of data collection was related to consistency: for example, if, for the Portuguese case, we collected data only including MFIs and, for the German case, non MFIs and MFIs, this would definitely lead to inconsistent results and biased conclusions. In order to avoid any inconsistencies resulting from criteria in data aggregation, the same databases and criteria to select data were used for each item for both PT and DE.

All data collected were gathered from the SDW of the ECB, except for the GDP per capita, which was collected from the BdP. Total assets (TA) pertain to all MFIs in each country and exclude the ESCB. Total Liabilities (TL) were calculated as the difference between Total Assets and Total Capital.

Data concerning to lending in both countries refer to loans reported by the MFIs, excluding ESCB, and with unspecified counterpart sector. Data pertaining to loan interest rates show the interest rates applied by the MFIs. The presented loan interest rates are divided into rates to loans to corporations and loans to households, and refer to outstanding amounts. In the same way, the deposits interest rates are also divided into rates to deposits of corporations and deposits to households and refer to outstanding amounts.

Unfortunately, the available data regarding the two above mentioned items does not extend to before 2003. Assuming the risk of limiting the accuracy of this study, we assume the same rates from January 2003 to prior years (from December 2002 until January 2000). This was done in order to avoid excluding these important variables from the models of Naceur and Kandil (2013), replicated in this study.

Data related to Consolidated Government Debt refer to the definition of the Maastricht Debt and it was only found on a quarterly basis. Since all other data collected so far was showing figures on a monthly basis, the linear interpolation method was used to allow the same frequency. In other words, this method was used in order to determine, approximately, an unknown value between two known values. For example, we know the figure of Government Debt in December and March and, by using the linear interpolation method as per below, we know, approximately, the figures for January and February:

$$(y_1 - y_0) * \frac{x - x_0}{x_1 - x_0}$$

Data regarding the GDP per capita deflator was also found in a quarterly basis, therefore the linear interpolation method was also applied. Although the interpolation method might compromise some results, it has been widely used in the literature due to its simplicity and robustness (Florescu et al., 2016). In this case, transforming quarterly data into monthly data, this method was the solution to ensure that the date sample could suit the monthly frequency needed to apply the models defined for this study.

4.2. The Variables

The variables in this study were prepared based in Naceur and Kandil (2013), in order to make possible the application of model 1 and model 2 of the linear multiple regression, presented in the next chapter.

Model 1 was applied 3 times, each time with a different dependent variable. Except for the first one, the other two variables are ratios that were calculated from the collected data.

- total assets (TA)
- ratio of government securities over total assets (GOVSEC/TA ratio)
- total assets to equity ratio (TA/E ratio)

In model 2, the dependent variable is the loan to total assets ratio (L/TA ratio) and, in this case, data concerning loans was collected, as well as Total Assets, and then the ratio was calculated in order to be applied in the model as a variable.

In each of the models, the following independent variables were used:

- The Post-Basel variable: this is a qualitative variable and stands as a dummy variable that equals 1 for each year after the implementation of the Basel Accord (0 otherwise), and was applied during four years, from 2005 and 2010, when the Basel II and III Accords were published. This variable allows assessing the variation of the Basel Accord implementation in banking portfolios.

- The difference between loan interest rates and deposit interest rates pertaining to corporations (DIFFcomp). This variable allows analysing profits arising from the margin between interest rates applied to loans and to deposits, in this case, to corporations.
- The difference between loan interest rates and deposit interest rates pertaining to households (DIFFhouse). The same aim concerns this variable, but, in this case, pertaining to margin arising from profits related to loans vs deposits for households.
- The GDP per capita deflator. This variable attests for the macroeconomic variations that, apart from the Basel Accords impact, can also have an impact in the banking portfolio behaviour. The variables concerning the differences are also included with the objective of attesting the demand-supply impact in portfolio and lending behaviour, testing if the macroeconomics conditions had a more significant impact in the portfolio behaviour than the implementation of the Basel Accords.

In model 2, besides the above mentioned independent variables, two more variables were added:

- E/TA ratio
- E/TA ratio*(Post-Basel dummy variable). In this case, the aim is to assess the relation between these two independent variables by understanding if there was a great variation in the E/TA ratio resulting from the implementation of the Basel Accord.

5. Regression Framework

The statistical development in this study is based on the methodology developed by Naceur and Kandil (2013). Several reasons justify the fact of this empirical study following the same steps used by Naceur and Kandil (2013). In general, the empirical framework was pertinent to explore the main goal of this study: did the Basel Accords implementation affect bank lending?

First, the fact that this paper is up to date with the last literature and empirical analysis results, due to its recent date of publication. For example, Berger and Udell (1994) also present a pertinent framework to develop this object of study, however their outcomes date from more than 20 years. Instead, some of their approaches are absorb and adjusted to the study developed by Naceur and Kandil (2013), explaining some of our results as well.

A second reason is the fact that the data range covers 15 years and, from the wide literature review undertaken, it was not an easy task to find empirical studies for such a long period. In our case, the aim of including a long period is related to the fact that the first Basel Accord was implemented in 1988, and we would like to assess the several post-Basel Accords implementation periods. Nonetheless, due to data limitations, our data does not cover the first years of Basel regulation. Thus, the analysis was applied from 2000 to 2016, which remains a considerable time period to assess and the main relevant periods to understand the current situation.

Also, Naceur and Kandil (2013), based in Berger and Udell (1994), present a model where the credit crunch is not assumed to have happened. This is the most common case in the literature: the empirical studies mainly focus the credit crunch time period or include only a short interval prior to the credit crunch. In this study, because the time range covers 16 years and because two different countries – Portugal and Germany – are focused, a long period of time is considered: either because a credit crunch might have occurred in slightly different times in each country and either because a control period is needed to test the first hypothesis of this study.

Berger and Udell (1994, p. 589) acknowledge that "research efforts that do not include a substantial control period cannot draw definitive conclusions about the existence of a credit crunch, since by definition a credit crunch is a reduction in credit crunch supply relative to the 'normal' supply, which can only be estimated from a control period".
In order to test if there was a credit crunch after the implementation of the Basel Accords (hypothesis 1), the analysis is developed by exploring how and why bank lending and capital characteristics differ between the credit crunch and control periods. Therefore the following model (1) is used:

$$D_{ijt} = \alpha_0 + \alpha_1 \text{Post - Basel - R.P}_{jt} + \alpha_2 X_t + \varepsilon_{jt}$$

Model 1 is used 3 different times, each time with a different dependent variable in order to test if, for that specific characteristic of the banking system, there was a variation between the pre- and the post- Basel periods:

D represents each of the dependent variables:

- the total assets (TA)
- the ratio of government securities over total assets (GOVSEC/TA ratio)
- equity to total assets ratio (E/TA ratio)

These three dependent variables were determined in order to assess if there were major changes in the asset portfolio behaviour of both the Portuguese and the German banking systems, in the pre- and post-Basel periods.

The TA variable accounts for what each banking system owns and can convert into cash, allowing liquidity in case of any economic constraints. The GOVSEC/TA ratio shows if, with the intention of replacing riskier assets (for example commercial loans) by less riskier assets, an increase of government securities (Public debt) can be acknowledged with this ratio. Finally, the E/TA ratio shows the variations in terms of the assets weight in relation to equity, providing an idea of risk management by each banking system and, therefore, if there were major changes in capital structure management, resulting from the Basel Accords implementation.

In each of the above cases, the independent variables used are:

- The Post-Basel dummy variable
- The DIFFComp
- The DIFFhouse
- The GDP per capita deflator

Regarding the hypothesis 2, model (2) is applied based on the following equation:

$$LAR_{ijt} = \alpha_0 + \alpha_1 Post\text{-}Basel\text{-}R.P_{jt} + \alpha_2 TCAPR_{jt} + \alpha_3 Post\text{-}Basel\text{-}R.P_{jt} \cdot TCAPR_{jt} + \alpha_2 X_t + \varepsilon_{jt}$$

LAR denotes the Loan to Total Assets ratio (L/TA ratio). In order to assess the variations in this ratio in the pre- and post-Basel periods, the independent variables used were the same as in model 1 (Post-Basel dummy variable; the DIFFComp; the DIFFhouse and the GDP per capita deflator, plus:

- Equity to Total Assets ratio (E/TA ratio)
- Equity to Total Assets ratio*Post-Basel (E/TA ratio*Post-Basel)

The three independent variables (DiffComp, Diffhouse and the GDP per capita deflator) used in both models 1 and 2 are defined as the macroeconomic variables. The aim of applying them is linked to the assessment of the impact of macroeconomic conditions in lending availability.

Naceur and Kandil (2013) raise importance to the fact that lending variations can be linked to credit supply and demand variations, independently of the minimum capital requirements implemented by the Basel Accords.

The three above macroeconomic variables are used to test variations from a demand-supply perspective: “for example, higher GDP growth would increase investor confidence, stimulating higher demand and supply of credit” (Naceur & Kandil, 2013, p. 15).

The independent variable E/TA ratio is used in order to assess variations in the asset portfolio behaviour: in case there is a higher sensitivity to risk and intentional actions to mitigate it due to MCR regulation, we would expect to see variations in this ratio. Also, in model 2 the relation between the two independent variables E/TA ratio and the dummy variable Post-Basel is assessed:

E/TA ratio*Post-Basel

The implementation of the Basel Accords is focused in terms of its impact on E/TA ratio. Risk sensitivity will be assessed through the interaction between these two variables.

6. Results

6.1. Descriptive Statistics

6.1.1. Average and Median

The descriptive statistics of this study includes the yearly average and median, as well as the growth rates, of the Total Assets, the Total Capital, the Total Lending and Government Debt, for both the Portuguese and the German case. It also includes financial ratios focusing the analysis of both banking systems in terms of leverage, equity and lending.

The number of observations for each variable in both the Portuguese and the German cases is 202. As shown in tables 1 to 4, the average of Total Assets, Total Capital, Total Lending and Government Debt is usually higher than the median (except for Total Assets) in the Portuguese case. On the contrary, in the German case, the average is lower than the median, except for the Government debt.

Table 1 – Total Assets – PT and DE

PORTUGAL		**GERMANY**	
TOTAL ASSETS		TOTAL ASSETS	
Average	Median	Average	Median
426.876,36	440.815,00	7.329.851,13	7.549.445,00

Table 2 – Total Capital – PT and DE

PORTUGAL		**GERMANY**	
TOTAL CAPITAL		TOTAL CAPITAL	
Average	Median	Average	Median
38.681,13	35.764,00	357.822,53	361.178,50

Table 3 – Total Lending – PT and DE

PORTUGAL		**GERMANY**	
TOTAL LENDING		TOTAL LENDING	
Average	Median	Average	Median
272.406,35	264.954,00	4.398.151,73	4.424.185,50

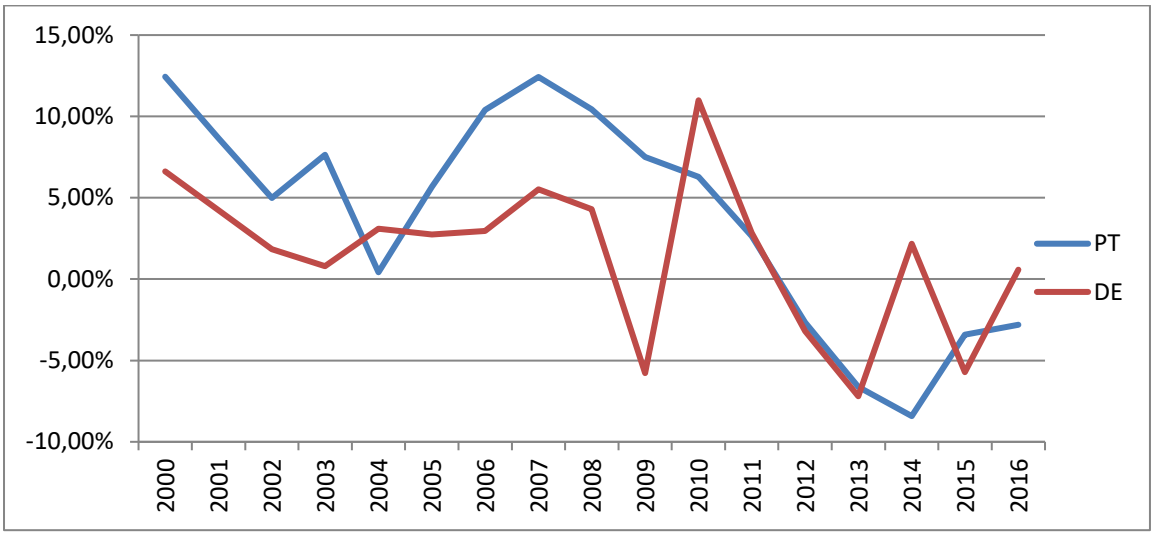
Table 4 – Government Debt – PT and DE

PORTUGAL		**GERMANY**	
Government Debt		Government Debt	
Average	Median	Average	Median
142.942,50	122.930,00	1.734.651,73	1.646.243,50

6.1.2. Growth Rates

Figures 1 to 5 show the annual growth rate of Total Assets, Total Capital, Lending and Government Securities for both the Portuguese and the German banking systems.

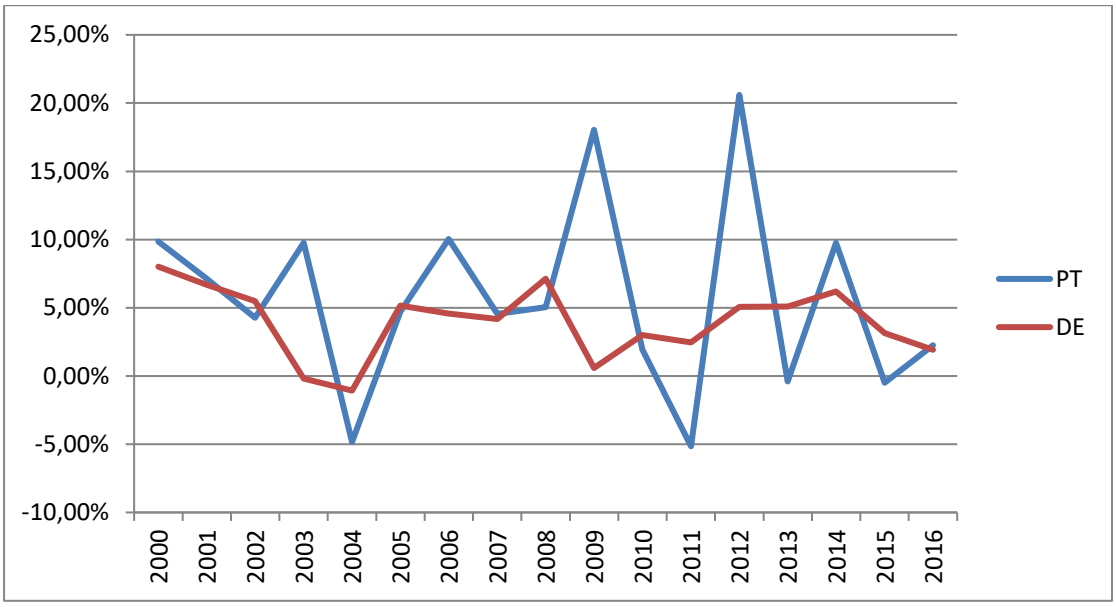
Figure 3: Total Assets Growth Annual Rate – PT & DE



The case of PT shows that after 2004, when the Basel II Accord was published, the TA gradually increased until 2007, when it started to decrease until 2014. No major changes can be found after 2010, when the Basel III Accord was released, instead the TA show a decrease from 2007 until 2014, which is associated to the worldwide financial crisis.

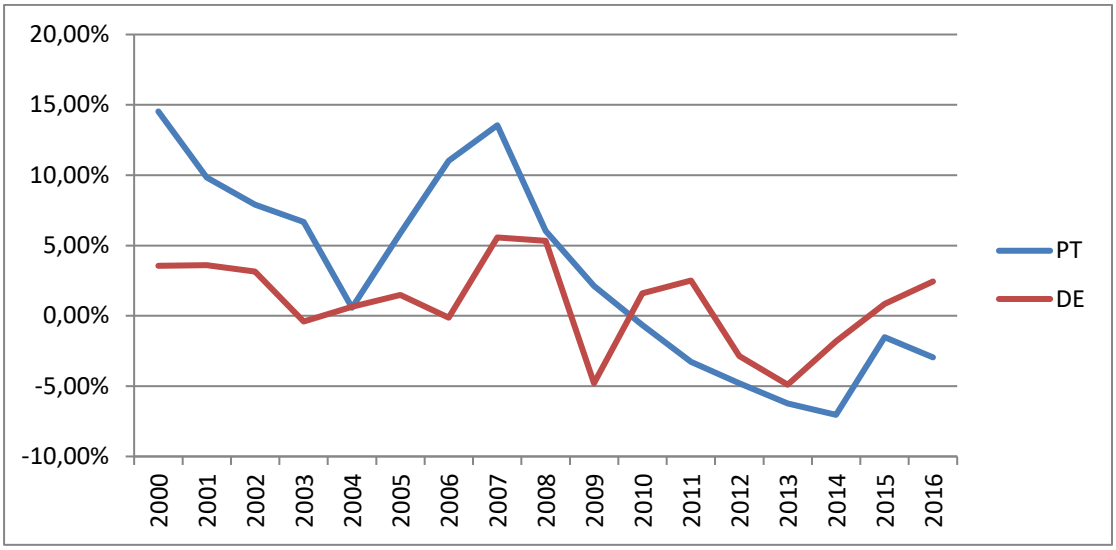
In the DE case, the decrease in 2008 of the TA is also associated to the financial crisis and, contrary to PT, the decrease between 2008 and 2009 and then the increase in 2010 are abrupt. In the following years, the same pattern can be found: again, in 2010, the TA decreases rapidly and, in 2013, the TA suddenly increased. The abrupt increase between 2009 and 2010 can be linked to diversification in bank's portfolios (Naceur & Kandil, 2013).

Figure 4: Total Capital Growth Annual Rate – PT and DE



Contrary to the first chart, in this case PT shows abrupt changes in The Capital annual growth rate, in opposition to DE which presents much gradual and stable figures. In 2008, PT increased from 5% to almost 20% in opposition to DE that decreased from 7% to 0.58%. However, in 2009, PT starts an abrupt decrease until 2011 but DE starts a slightly increase until 2014 and remains stable with small ups and downs. In 2001, PT suddenly increases again Capital, growing to 20%, however, again in the next year, it falls abruptly.

Figure 5: Total Lending Growth Annual Rate – PT and DE

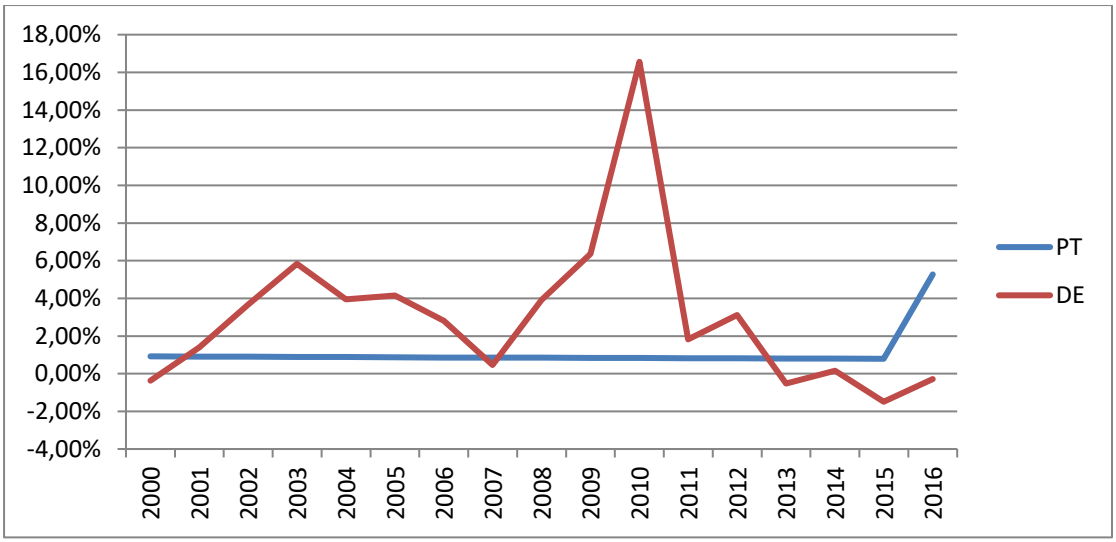


The annual growth rate of Lending in PT case shows a very similar pattern comparing to TA data. It reveals that the Portuguese banking system based its TA especially on lending activity. Therefore, once lending started to present a decrease in 2007, TA followed the same pattern: both TA and lending decreased until 2014, falling from 12.4% and 13.7%, in 2007, to - 8.42% and -7.04%, in 2004.

It is important to say that, when focusing the TA mainly in one activity kind, the risk of loss is higher due to the lack of diversification of assets. In this case the risk can have two levels: first, when lending initiated a fall (probably because of loan contraction), TA also decreased; secondly, with such high proportion of assets resulting from lending activity, in case of a high number of defaults, TA will also substantially decrease.

In the case of DE, lending activity also falls from 2008 to 2009, showing the same pattern as in TA. However, in 2009, lending activity starts to raise but not as much as TA. According to Naceur and Kandil (2013), this will mean a diversification of the bank's portfolio to enable TA increase regardless the lending activity. This diversification also reflects a higher sensitivity to risk which will contribute to decrease riskier assets (such as loans) from the portfolios and replace them by less riskier assets (such as government securities).

Figure 6: Total Government Securities Growth Annual Rate – PT and DE



In the DE case, the reasoning of Naceur and Kandil (2013) that, due to higher risk sensitivity, banks could decrease riskier assets (loans) and increase less riskier assets (government securities) seems to make sense. In fact, TA and lending activity fall and then begin to raise, but with GOVSEC showing a much higher increase that affects much more TA than the lending activity. TA grows from -6% to 10%, GOVSEC grows from 6% to 16%, however lending only shows a growth of no more than 5.6%.

In the PT case, GOVSEC does not present any changes until 2014, which reveals that financial strategy during these years did not include GOVSEC trading in a substantial way.

6.1.3. Financial Ratios

As an important tool to assess the financial health of both banking sectors, ratios were used in order to allow a comparison during time and across the two banking sectors. Therefore, analysis can be developed in relation to past values in each case, providing information on changes in the financial situation over time, and in relation to another company or, in this case, banking system within the same sector (Robinson et al., 2009). Besides being an important tool in assessing the financial resilience of the banking system, ratios were also calculated since they will be used, as previously mentioned, as variables in the multiple regression analysis.

A. Leverage Ratios

The first 3 ratios presented are related to the capital structure of both banking sectors in PT and DE and show the weight of debt and equity that is being used for financing the assets of both sectors.

Table 5 – Leverage Ratios – PT and DE

Country	Annual Average	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
PT	D/TA ratio	0,91	0,91	0,91	0,91	0,91	0,92	0,91	0,92	0,92	0,92	0,92	0,92	0,92	0,90	0,88	0,87	0,87
DE	D/TA ratio	0,96	0,96	0,96	0,95	0,96	0,96	0,95	0,95	0,95	0,95	0,95	0,95	0,95	0,95	0,94	0,94	0,94
PT	D/E ratio	10,50	10,62	10,49	10,62	10,47	11,11	10,71	11,05	11,81	11,62	11,73	12,23	11,40	9,41	7,66	6,91	6,77
DE	D/E ratio	23,20	22,63	21,36	20,96	22,00	22,37	20,30	20,28	20,57	19,80	19,59	20,02	20,11	17,44	16,04	15,83	15,36
PT	TA/E ratio	11,50	11,62	11,49	11,62	11,47	12,11	11,71	12,05	12,81	12,62	12,73	13,23	12,40	10,41	8,66	7,91	7,77
DE	TA/E ratio	24,20	23,63	22,36	21,96	23,00	23,37	21,30	21,28	21,57	20,80	20,59	21,02	21,11	18,44	17,04	16,83	16,36

Concerning PT, the Total Debt to Total Assets Ratio (TD/TA Ratio) is constant from 2000 to 2012 on the 92% to 91%, however from 2013 afterwards a decrease is presented, being in 2016 87%. In the case of Germany this ratio is also constant (96% to 95%) until 2014, and then a decrease of 1% is registered, not being as significant as in the Portuguese case.

Concerning the Debt to Equity Ratio, in both cases the figures are constant until 2012 (rounding between 10.4% to 12.2% in Portugal; and 19.5% to 23.3% in Germany) and from 2013 afterwards both countries register a decrease of 3.7% and 3.2% respectively. The Total Assets to Equity Ratio (TA/E ratio) is also a leverage ratio and the higher it is, the higher is the financing on debt, indicating a high level of assets but low level of equity. Consistently with the two previous ratios, also in this ratio both countries show constant figures until 2013 and, afterwards, a decrease of 5.46% for PT and of 7.84% for DE. In other words, in these 3 ratios both countries present constant figures until 2013 and then a decrease, which are significant except for DE, as mentioned above, that in the Total Debt to Total Assets Ratio only shows a small decrease of 1%.

Because these ratios focus on how leveraged a sector is, high debt in relation to total assets and to equity would reveal high financial risk. Although this would be the case with corporations, when looking into the banking industry and into the examples above, the same conclusion cannot be immediately inferred. Banks borrow so they can lend, but in-between they borrow at a lower rate and lend at a higher rate. Briefly, the main product that banks sell is debt, therefore these ratios cannot be taken into account in a single manner; otherwise they can be misleading. The banking industry will tend to show high debt, although debt generating income (unless the number of loans in default is high).

B. Equity Ratios

In this section, the E/TA ratio and the E/D ratio are focused. The first ratio shows what percentage of the assets belongs to shareholders, instead of belonging to debt holders: the higher this ratio is, the larger percentage of assets is owned by shareholders. In other words, this ratio can also reveal information on bank's leverage, which will be high in case equity is not significantly part of the assets financing (debt will be).

The second ratio (E/D ratio) is a solvency ratio that points out the ability of banks to cope with financial distress, since it shows the percentage of financing that depends on ownership or on debt. In this case, the lower is this ratio, the higher it is the bank's vulnerability to financial distress, because of high dependency on liabilities as the way to finance assets.

Robinson et al. (2009) underline how the adequacy of equity capital is a key factor to be considered when the soundness of a bank is assessed. An adequate equity or capital base serves as a cushion to absorb possible losses in case of financial distress.

Table 6 – Equity Ratios – PT and DE

Country	Annual Average	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
PT	E/TA ratio	0,09	0,09	0,09	0,09	0,09	0,08	0,09	0,08	0,08	0,08	0,08	0,08	0,08	0,10	0,12	0,13	0,13
DE	E/TA ratio	0,04	0,04	0,04	0,05	0,04	0,04	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,06	0,06	0,06
PT	E/D ratio	0,10	0,09	0,10	0,09	0,10	0,09	0,09	0,09	0,08	0,09	0,09	0,08	0,09	0,11	0,13	0,14	0,15
DE	E/D ratio	0,04	0,04	0,05	0,05	0,05	0,04	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,06	0,06	0,06	0,07

Looking at Table 2, the E/TA ratio of Portuguese banks show that figures were constant until 2013 (8% to 9%), increasing each year after, and reaching 13% in 2016. This means that equity increased its percentage in terms of assets financing or, in other words, that leverage decreased 5%, since 2012 to 2016.

In the case of DE, figures are also constant and an increase is also registered from 2013, however this increase is not as significant as in the Portuguese case. Only a 1% increase was registered, from which can be suggested that there was not a considerable change in the capital structure of the German banking system.

The same pattern seems to be present in the E/D ratio for both countries: in PT, until 2013 this ratio varies between 8% to 10% and then increases reaching 15% in 2016. In DE, until 2013 this ratio varies between 4% and 5%; although there is an increase after, it was not higher than 7%.

C. LOAN TO TOTAL ASSETS Ratio (L/Ta ratio)

The L/TA ratio measures the percentage of loans in relation to the assets of a bank: how much of the assets derive from loans and their interest rates. When this ratio is high, it can mean that banks have high earnings. However, in case of social-economic constraints, a high L/TA ratio can mean high risk and distress due to probability of default from borrowers.

Table 7 – L/TA ratio – PT and DE

Country	Annual Average	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
PT	L/A ratio	0,69	0,71	0,74	0,70	0,71	0,71	0,71	0,72	0,71	0,66	0,62	0,59	0,55	0,55	0,55	0,56	0,56
DE	L/A ratio	0,66	0,65	0,65	0,65	0,63	0,61	0,60	0,59	0,59	0,60	0,60	0,56	0,56	0,58	0,57	0,56	0,58

In PT, this ratio shows constant figures between 69% and 72% until 2008. In the following year there is a significant decrease of 5% and, in the following years, this ratio continues to decrease, showing 56% in 2016.

In DE, the situation was different and the figures presented again as constant. Since 2000, there was a decrease of 1% to 2% each year, and only from 2010 to 2011 a decrease from 60% to 56% was registered. Subsequently, the figures increased and continued to be constantly between 56% and 58%.

When comparing PT and DE, the figures show that, during the 16 years being analysed, the L/TA ratio decreased 19% and 10% respectively. Based on the fact that a high number of loans might lead to high financial distress due to defaults, it is also worth to underline that the ratio decrease in PT overlaps the financial crisis period, which started in 2008 and had severe consequences in the following years.

D. GOVSEC/TA Ratio

This ratio shows the weight of government securities in the total assets and if there were many changes in portfolio banking behaviour such as the increase of government securities and (implicit) decrease of loans as a way to decrease risk (Naceur and Kandil, 2013).

Table 8 – GOVSEC/TA ratio – PT and DE

Country	Annual Average	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
PT	GOVSEC/TA ratio	0,53	0,50	0,46	0,41	0,36	0,33	0,30	0,28	0,27	0,28	0,29	0,29	0,26	0,24	0,25	0,24	0,24
DE	GOVSEC/TA ratio	0,27	0,27	0,28	0,28	0,25	0,26	0,25	0,23	0,21	0,22	0,22	0,22	0,22	0,21	0,20	0,20	0,21

In the PT case, this ratio shows a gradual and significant fall since 2000 until 2016, since it falls from 53% to 24%. Although in DE case, this ratio also falls since 2000 until 2016, its decrease is not as significant as in the PT case: in 2000, this ratio shows for the DE case 27% and continues to decrease but not more than 21%.

Generally, when the ratios above mentioned show a decrease, this usually happens in relation to both countries. However, in the DE case often the decrease is not as significant as in the PT case.

Although descriptive statistics are interesting regarding data interpretation, this may often provide only informative results but somehow insufficient to reach major conclusions. Therefore, and as already stated, an econometric model is presented, based on models from Naceur and Kandil (2013).

6.2. Regression Results

The complexity of the subject addressed in this dissertation, as well as the fact that it includes two cases studies – PT and DE, led us to search amongst the literature an empirical model that would suit our main study objective. Therefore, the multiple linear regression was developed in this study based on the models from Naceur and Kandil (2013).

Consequently, we assume that the assumptions of multiple linear regression were all tested and validated, such as: the variables are normally distributed, there is little or no multicollinearity and there is little or no auto-correlation.

In general, the focus on this chapter will be to analyse the p-value for each variable and test the null hypothesis that the coefficient is equal to zero, i.e., it has no effect in the dependent variable. A low p-value (<0.05) shows that the null hypothesis can be rejected. In other words, the independent value that has a low p-value means that it is meaningful to the dependent variable, because changes in the independent variable are related to changes in the dependent. On the contrary, a larger (and insignificant) p-value means that changes in the dependent variable are not related to the independent variable being focused.

Besides concluding about statistical significance, it is important to analyse if the significant relation between the dependent and the independent variables is positive or negative. If it is positive, it means that the dependent variable is expected to increase whenever the independent variable increases; if it is negative, the dependent variable is expected to decrease whenever the independent variable increase.

Because this study refers to regression with multiple independent variables, each coefficient shows how much the dependent variable is expected to increase or decrease due to the specific independent variable impact, assuming all other independent variables as constant. The quality of the model is also assessed through the Adjusted R2 value.

6.2.1. Regression Results– Portugal

Model 1, with the dependent variable TA, shows the R2 = 94.1% which represents a model with high quality. In other words, the variation of Total Assets is accounted for DIFFComp, DIFFhouse, GDP per capita and the Post-Basel variable, in a proportion of 94.1% (Appendix I).

This model shows that all independent variables are significant, except Post-Basel, in the variations of Total Assets. In other words, after the implementation of the Basel Accords, the growth of TA does not result from MCR. Instead, the variations in TA are explained by macroeconomic variables, such as GDP per capita, DIFFComp and DIFFhouse. However, the 3 significant independent variables show a negative relation, meaning that when the GDP per capita, the DIFFComp and the DIFFhouse increase 1%, the Total Assets decreases 48.7%, 35.7% and 50.7%, respectively. A negative and significant result of DIFFComp and DIFFhouse points out an increase in the cost of lending for both companies and families, contributing to a depression in the demand for credit and, therefore, to a credit and TA growth slowdown (Naceur& Kandil, 2013).

Appendix II shows model 1, with the dependent variable E/TA ratio. This model shows that, except for the DIFFhouse, all the independent variables are significant in explaining variations in the E/A ratio. However, the Post-Basel has a negative effect on due E/TA ratio, in other words, it is not responsible for its growth since after its implementation there is no growth in this ratio.

The two independent variables (DIFFComp and GDP per capita) present a stronger significance and negative impact in relation to the E/TA ratio: whenever the DiffComp increases 1%, the E/A ratio decreases 63.6%, which contributed to lower GDP per capita impacting this ratio. A negative and significant DIFFComp reveals a higher cost of lending resulting from a widening differential between loans and deposits interest rates. Because of higher cost of lending, in this case, especially focusing companies, economic growth is compromised. Thus, GDP per capita is also compromised and its (potential) positive impact in E/TA of the Portuguese banking system.

Appendix III presents model 1, with the dependent variable GOVSEC/TA ratio, which can be considered a model with very good quality since it shows an Adjusted R2 value = 82.6%. In other words, 82.6% of the variations of the dependent variable are explained by variations of DIFFComp, DIFFhouse, GDP per capita and the Post-Basel. The 3 independent variables (DIFFComp, DIFFhouse and GDP per capita) show a strong significance, but different effects on the dependent variable. When DiffHouse increases by 1%, this ratio decreases 30.2%. However, the other two independent variables are significant and present a positive effect on the dependent variable. When DIFFComp raises 1%, this ratio increases by 38.6%, and when GDP increases 1%, the ratio increases 58.3%.

The Post-Basel variable is significant in this case, but not as much as the other 3 macroeconomic variables. The results show that when the Post-Basel implementation took place, the GOVSEC/TA ratio decreased 10.5%. In other words, the assumption of Naceur and Kandil (2013) that the GOVSEC could raise after the implementation of the Basel Accords as a solution to meet MCR (and decreasing therefore riskier assets) was not traceable in the PT case.

Appendix IV presents model 2, with the dependent variable L/TA ratio and with two more independent variables: the E/TA ratio and E/TA*Post-Basel. This model has an excellent quality, since 95% of the variations of L/TA ratio are explained by the included independent variables (Adjusted R2 value = 95%). In this model, the independent Post-Basel shows a significant and negative impact on the L/TA ratio, meaning that after the implementation of the Basel Accords there was a decrease of 46.7% of loans.

Also, the independent variable E/TA ratio*Post-Basel shows a significant and positive effect. According to Naceur and Kandil (2013), when this variable has a positive effect on L/TA, it means that there is a risk retrenchment as a result of the Basel Accord implementation concerning loans availability. In the PT case, after the Basel Accords, sensitivity to risk increased, thus, risk retrenchment occurred for 50.2% and, therefore, loans availability decreased as a response to decrease risk.

Model 2 also shows how DIFFhouse has a significant and positive effect in L/TA. Whenever DIFFhouse increases 1%, L/TA increases 91.5%. This reveals how the banking system in PT prioritized lending to households in order to have significant and fast revenues. However, due to high risk of default not taken into consideration, loans to families did not return the expected revenues contributing to economic constraints in the country.

On the contrary, investment in companies, especially in SMEs, was not focused in the same way as with households lending availability, compromising manufacturing, production and consumption (GDP per capita is no higher than 4.2%). The lack of investment in SMEs has been focused on research, which has been growing towards this subject. Farinha & Felix (2014) show that especially smaller SMEs are the ones requesting loans to banks and how fundamental this kind of funding is for their daily maintenance in terms of production. In other words, SMEs usually do not have any other option to fund themselves and, in case of low credit availability, their financial survival is often compromised.

The lack of investment in SMEs through credit availability makes it difficult for the Portuguese economy to prosper in a faster and wider way. According to Reis (2009), corporate diversification is essential in any economy and lack of corporate investment in the case of PT led, for example, to a low percentage of exports of GDP (20%).

6.2.2. Regression Results – Germany

Model 1, with the dependent variable TA, shows a good quality since 82.5% of the variations of the TA in Germany are explained by the independent variables included in this model (Appendix V).

The significant and positive effect of the dummy variable Post-Basel indicates a relevant growth of 35.1% of the TA after the Basel Accords implementation. The other two significant variables, showing an impact in TA changes, are DIFFComp and DIFFhouse. However, DIFFComp presents a positive effect, whereas DIFFhouse presents a negative effect. When the first increases 1%, TA increases by 44.5%, but when the second increases 1%, TA decreases 87.5%. In other words, TA grew due to corporate investment made accessible through bank lending availability.

On the contrary, the cost of lending to families increased and availability or accessibility to it decreased. In a nutshell, this reveals that in DE companies were more focused than families in terms of lending availability as a strategy to strengthen economy.
Model I, with the dependent variable E/TA, does not present good quality because the independent variables are only able to explain 67.6% of the variation of E/TA ratio (Appendix VI).

However, it is worth to check that in this model the Post-Basel variable is not significant. On the contrary, the other three variables are significant, especially the DIFFComp and DIFFhouse, being interesting to note that this ratio is more influenced by the macroeconomic variables than by the Post-Basel.

Following the above results of model 1 with the dependent variable TA, we observe that DiffComp has also a positive effect and, in opposition, DiffHouse has a negative effect on E/TA ratio. As a result of the corporate investment enhanced by lending availability to companies (the positive effect of DIFFComp in this ratio), GDP per capita also presents a positive effect, showing that, due to corporate investment and consequent production and exports growth, GDP per capita also increased (15%).

Model 1, with the dependent variable GOVSEC/TA ratio, presents high quality since the independent variables explain by 82.8% the variations found in this ratio (Appendix VII).

The variables Post-Basel and both Diffs are significant in explaining the changes in the GOVSEC/TA ratio. The Post-Basel shows a positive effect, revealing that after its implementation this ratio increased by 28.7%. In other words, this means that with the implementation of the Basel Accords there was an increase of government securities being bought.

These results are consistent with the fact that, after the Basel implementation, sensitivity to risk could increase and riskier assets could be replaced by less riskier assets in order to meet MCR. Therefore, parallel to an increase of government securities in Post-Basel period, loans to families decreased (negative effect of this variable for 86.2%).

In appendix VIII, the results for model 2 can be observed: with the dependent variable L/TA ratio and with two more independent variables (E/TA ratio and E/TA ratio*PostBasel) this model shows a very good quality since 81.1% of the variations of L/TA ratio are explained by the independent variables (Adjusted R2 value = 81.1%).
All the variables are significant, except the E/TA ratio. The Post-Basel and both Diffs are the variables that show stronger significance to explain the dependent variable. In this case, the Post-Basel has a negative effect, showing that after its implementation loans decreased by 33.7%.

Also, both Diffs are significant in this case: whenever the DIFFhouse increased 1%, the ratio L/TA also increased 66.3%; whenever the DIFFComp raised 1%, the ratio L/TA decreased 27.4%. In this case, the positive result of Diffhouse shows that lending availability to families was also taken into account, attesting for diversification in terms of earning-sources in the German banking system.

The variables ratio E/TA and ratio E/TA*Post-Basel are not significant and present a negative effect on L/TA ratio. From the independent variable ratio E/TA*Post-Basel it is suggested that there was no major changes in the ratio E/TA with the implementation of the Basel Accords.

In general, in the DE case, the high corporate investment as well as the diversification of earning-sources, through the purchase of government securities, allowed DE to position itself as one of the first export leaders of the world: “Only one decade ago, Germany was called the sick man of Europe. Nowadays, the same comments speak about Germany as Europe’s engine” (Funk, 2012, p. 5).

In fact, in 2016, DE was acknowledged as one of the largest exporters in the world, being the largest manufacturing economy in Europe mainly of products such as vehicles, machineries, electrical and transport equipment and pharmaceutics (amongst other products).

7. Conclusion

Despite applying the models developed by Naceur and Kandil (2013), our results are opposite to theirs. In both case studies – PT and DE, the results suggest that the Basel Accords were responsible for a decrease in loans of 46.7% (in PT) and 33.7% (in DE).

We also found that in PT, there was a loan retrenchment of 50.2% due to higher sensitivity to risk and the need to decrease vulnerability to it (shown by the results given in E/TA*Post-Basel, in model 2). Also, in DE, model 1, with the dependent variable GOVSEC/TA ratio, show that there was an increase of government securities purchases, after the Basel Accords. According to Berger and Udell (1994), this effect shows evidence of a credit crunch. Banks chose to decrease loans (riskier assets) and replace them by government securities (less riskier banks) in order to comply with MCR. As a consequence, loans availability decrease, which can lead to a slowdown of economic growth.

Another interesting aspect is to note that PT invested mainly in lending to families, while DE diversified economic strategy and made also available lending to companies. In both cases lending is of major importance in contributing to economic growth, however, while in DE corporate investment led to economic growth, in PT the almost exclusive lending availability to families led to economic constraints, due to difficulties from these families in paying back their loans.

Furthermore, results in model 1, concerning portfolio diversification, show that in both countries the Basel Accords were less significant to portfolio behaviour changes than the macroeconomic variables.

Similarly, in model 2, results suggest that both the Post-Basel variables and the macroeconomic variables (DIFFComp and DIFFhouse) are significant in affecting loans growth.

Although the above results are validated by Naceur and Kandil's (2013) methodology, we recognise several limitations in this study that were not addressed in the mentioned article and, therefore, could be a matter for future research.

For example, data pertaining to lending was not specified in categories and focused on a more detailed approach. Therefore, some important considerations and results were missed. In our study, lending includes data pertaining to the loans reported by the MFIs, thus, by not including the Mutual Guarantee Societies (MGS) an important aspect is missed, since lending granted by the MGS have been raising since a while in PT.

Also, by not addressing lending in a more detailed way, for example by distinguishing exporting companies from non-exporting companies, the results miss an important aspect in the reorganization of the Portuguese corporate environment: lending decreased in the non-exporting companies, however it increased in exporting companies, showing how available lending was redirected to exporting activity in the country. Also, programs such as PME Líder and Caixa Capitalizar reflect the will to promote corporate investment.

Furthermore, based in Naceur and Kandil (2013), data pertaining to lending was included in the study as the ratio Loans to Total Assets. However, lending and GDP are endogenous variables and, if lending is addressed in relation to the GDP, we can see that, in fact, lending has not been decreasing in PT.

The results from this study suggesting shrinkage of lending due to the Basel Accords regulation can be argued when the above aspects are taken into consideration. Further research in this sense can be thus an interesting subject for future studies.

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APPENDIXES

Regression analysis results for PT:

I. Model 1 – Dependent Variable: TA

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,970[a]	,942	,941	23917,77956

Predictors: (Constant), GDP per capita, DIFFComp, DIFFhouse, PostBasel

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1824274069792,836	4	456068517448,209	797,239	,000[b]
	Residual	112695855251,501	197	572060178,942		
	Total	1936969925044,337	201			

Dependent Variable: TotalAssets

Predictors: (Constant), GDP per capita, DIFFComp, DIFFhouse, PostBasel

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	149004,846	32465,258		4,590	,000
	PostBasel	-5315,270	4289,601	-,027	-1,239	,217
	DIFFComp	-77784,392	4369,482	-,357	-17,802	,000
	DIFFhouse	-43363,704	2214,545	-,507	-19,581	,000
	GDP per capita	5504,784	297,647	,487	18,494	,000

a. Dependent Variable: TotalAssets

Model 1 – Dependent Variable: E/TA Ratio

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,830[a]	,689	,682	,00931

a. Predictors: (Constant), GDP per capita, DIFFComp, DIFFhouse, PostBasel

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,038	4	,009	109,005	,000[b]
	Residual	,017	197	,000		
	Total	,055	201			

a. Dependent Variable: RatioEquitytoTotalAssets

b. Predictors: (Constant), GDP per capita, DIFFComp, DIFFhouse, PostBasel

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-,029	,013		-2,272	,024
	PostBasel	-,007	,002	-,205	-4,116	,000
	DIFFComp	,023	,002	,636	13,696	,000
	DIFFhouse	,000	,001	-,016	-,270	,788
	GDP per capita	,001	,000	,440	7,227	,000

a. Dependent Variable: RatioEquitytoTotalAssets

Model 1 – Dependent Variable: GOVSEC/TA Ratio

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,911[a]	,830	,826	,03817

a. Predictors: (Constant), GDP per capita, DIFFComp, DIFFhouse, PostBasel

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1,399	4	,350	240,152	,000[b]
	Residual	,287	197	,001		
	Total	1,686	201			

a. Dependent Variable: RatioGovernSectoTotalAssets

b. Predictors: (Constant), GDP, GDP per capita, DIFFComp, DIFFhouse, PostBasel

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-,351	,052		-6,777	,000
	PostBasel	-,019	,007	-,105	-2,848	,005
	DIFFComp	,078	,007	,386	11,236	,000
	DIFFhouse	-,024	,004	-,302	-6,832	,000
	GDP per capita	,006	,000	,583	12,952	,000

a. Dependent Variable: RatioGovernSectoTotalAssets

Model 2 – Dependent Variable: L/TA Ratio

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,975[a]	,951	,950	,01620

a. Predictors: (Constant), RatioEquityTotalAssets, RatioEqTotaAssets*PostBasel, DIFFhouse, DIFFhouse, GDP per capita, PostBasel

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1,001	6	,167	635,665	,000[b]
	Residual	,051	195	,000		
	Total	1,052	201			

a. Dependent Variable: RatioLoanTotalAssets

b. Predictors: (Constant), RatioEquityTotalAssets, RatioEqTotaAssets*PostBasel, DIFFhouse, DIFFhouse, GDP per capita, PostBasel

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	,611	,022		27,411	,000
PostBasel	-,069	,017	-,467	-3,949	,000
DIFFComp	,012	,004	,076	2,752	,006
DIFFhouse	,058	,002	,915	36,544	,000
GDP per capita	,000	,000	,042	1,459	,146
RatioEqTotaAssets*PostBasel	,835	,182	,502	4,591	,000
RatioEquityTotalAssets	-1,452	,132	-,331	-10,991	,000

a. Dependent Variable: RatioLoantoTotalAssets

Regression analysis results for DE

V. Model 1 – Dependent Variable: TA

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,910[a]	,828	,825	321849,45311

a. Predictors: (Constant), GDP per capita, DIFFComp, DIFFhouse, PostBasel

ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9847347332205 3,880	4	2461836833051 3,470	237,659	,000[b]
	Residual	2040665288177 5,500	197	103587070465, 865		
	Total	1188801262038 29,380	201			

a. Dependent Variable: TotalAssets

b. Predictors: (Constant), GDP per capita, DIFFComp, DIFFhouse, PostBaseL

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	8978200,342	335456,209		26,764	,000
PostBasel	548369,755	48141,458	,351	11,391	,000
DIFFComp	979907,375	84975,073	,445	11,532	,000
DIFFhouse	-1602288,985	76451,257	-,872	-20,958	,000
GDP per capira	6803,265	2469,005	,101	2,755	,006

a. Dependent Variable: TotalAssets

VI. Model 1 – Dependent Variable: E/TA ratio

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,822[a]	,676	,669	,00393

a. Predictors: (Constant), GDP per capita, DIFFComp, DIFFhouse, PostBaseL

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,006	4	,002	102,785	,000[b]
	Residual	,003	197	,000		
	Total	,009	201			

a. Dependent Variable: RatioEquityTotalAssets

b. Predictors: (Constant), GDP per capita, DIFFComp, DIFFhouse, PostBaseL

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,062	,004		15,208	,000
	PostBasel	,000	,001	-,018	-,418	,676
	DIFFComp	,009	,001	,465	8,776	,000
	DIFFhouse	-,014	,001	-,850	-14,869	,000
	GDP per capita	8,996E-005	,000	,150	2,980	,003

a. Dependent Variable: RatioEquityTotalAssets

VII. Model 1 – Dependent Variable: GOVSEC/TA Ratio

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,912[a]	,832	,828	,01183

a. Predictors: (Constant), GDP per capita, DIFFComp, DIFFhouse, PostBaseL

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,136	4	,034	243,260	,000[b]
	Residual	,028	197	,000		
	Total	,164	201			

a. Dependent Variable: RatioGovernSecTotalAssets

b. Predictors: (Constant), GDP per capita, DIFFComp, DIFFhouse, PostBaseL

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,242	,012		19,660	,000
	PostBasel	,017	,002	,287	9,401	,000
	DIFFComp	,074	,003	,908	23,763	,000
	DIFFhouse	-,059	,003	-,862	-20,923	,000
	GDP per capita	2,065E-005	,000	,008	,228	,820

a. Dependent Variable: RatioGovernSecTotalAssets

VIII. Model 2 – Dependent Variable: L/TA Ratio

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,904[a]	,816	,811	,01433

a. Predictors: (Constant), RatioEquityTotalAssets, DIFFComp, PostBasel, GDP per capita, RatioEquityTotalAssets*PostBasel, DIFFhouse

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,904[a]	,816	,811	,01433

a. Predictors: (Constant), RatioEquityTotalAssets, DIFFComp, PostBasel, GDP per capita, RatioEquityTotalAssets*PostBasel, DIFFhouse

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,591	,022		26,793	,000
	PostBasel	-,023	,003	-,337	-8,684	,000
	DIFFComp	-,026	,005	-,278	-5,288	,000
	DIFFhouse	,052	,005	,663	10,354	,000
	GDP per capita	,000	,000	-,121	-3,123	,002
	RatioEquityTotalAssets*PostBasel	-,217	,065	-,135	-3,354	,001
	RatioEquityTotalAssets	-,702	,269	-,146	-2,609	,010

a. Dependent Variable: RatioLoanTotalAssets