Impacts of Basel III announcements on European bank business models

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Abstract:

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The Basel regulation put forth by the Basel Committee of Banking Supervision (BCBS) is an ambitious endeavor that aims at regulating the banking industry worldwide. The Basel III accord introduced in 2010 is the latest iteration of this effort. Implementation of Basel III is well underway today and programmed to take full effect in 2019. The criticism towards Basel III is mainly pointed towards the negative impact it could have on the economy and the profitability of banking institutions. In addition, the impacts on different banking business models could be heterogeneous, benefitting some models more than others. The main question this thesis tries to answer is if wealth effects on European exchange traded banks brought by Basel III will be negative and if different business models will be impacted differently. To answer this question a group of European banks were selected. Bank business models were assigned using the k-means clustering algorithm where banks are clustered into traditional vs. non-traditional categories depending on the asset and liability structure of the balance sheet. An event study is then conducted to measure the wealth effects caused by the introduction of Basel III on an aggregate level and by business model. The event studies are conducted on six key dates from press releases by the BCBS to better capture the full effects of Basel III. Lastly, a regression model is used to check whether there is any relationship between the abnormal returns on the pre-specified event dates and bank business models. This thesis finds that impacts on different event dates were not homogenous: some resulted in positive abnormal returns and some negative therefore it was not possible to conclude if the impact of Basel III was negative on European exchange traded banks. From the results, it was not possible to conclude if any business model is impacted more or less severely by Basel III. The results suggest that there are more dynamics at play that could influence the value of exchange traded European banks.

Contents Page

1 - Introduction

The banking industry is of vital importance for a healthy and thriving economy. In its most traditional form, banks provide liquidity, grant credit, and offer deposit and transaction services that cater to both individuals and businesses alike. Financial institutions play a central role in the economy, so it is understandable why crises in the financial system can be so devastating for the economy. Unfortunately, financial crises are not uncommon events. In the past, financial crises were associated with bank runs and were arguably the most feared events by bankers. Today such events have become scant mostly owing to government deposit guarantees and a bigger emphasis by regulators on depositor safety. Today's regulation, namely the Basel accords, has two main objectives. The first objective is focused towards building up the resilience of the banking industry by increasing capital requirements, so banks are adequately capitalized to resist financial stress and avoid potential spillovers into the real economy. The second objective is focused on designing homogenous regulation to maintain a level playing field in the financial industry worldwide and erase any potential advantages that could arise from geographic location.

The financial industry changed dramatically in the last 30 years, becoming more complex and interconnected at a worldwide scale. As the financial system evolves, new risks arise, and financial crisis are manifested in different ways. The financial crisis of 2007 is proof of how unsupervised financial innovation can backfire and severely damage the world economy. In the US, the subprime crisis is considered the deepest recession since the great depression of 1929. It is in the interest of everyone that crisis events do not happen in the future. Consequently, the Basel III regulatory framework was the response designed by the Basel Committee on Banking Supervision (BCBS) to this latest crisis. The new Basel III regulatory framework builds on the previous Basel II and Basel I frameworks. The main contributions from the introduction of Basel III are stricter capital requirements and the introduction of liquidity requirements, respectively the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR). BCBS main objective remains static with each new iteration of the Basel accord which can be summarized as promoting the resilience of banking institutions to increase stability in the financial system at a worldwide scale. It is widely agreed that a global regulatory framework is necessary therefore an accord such as the Basel III is not just desirable but also necessary. Basel III is the most comprehensive and wide-reaching effort undertaken in

banking regulation to this day. Despite its implementation being well underway in a large scale today, there is still criticism about certain components of the framework which are welcomed to devise a yet better Basel IV in the future.

As mentioned, Basel III does not come without its critics. After the Basel III announcement, criticism soon followed via reports from respectable institutions and academic researchers. One of the main arguments against the current Basel framework is that to build up capital ratios, a lot of additional capital will be needed that could reduce credit availability and/or increase the cost of credit (KPMG, 2011). It is estimated that banks' return on equity (ROE) will suffer a reduction of as much as 4% on average for European banks (McKinsey&Company, 2010). Other critics say that Basel III will have a negative effect on the competitiveness, profitability, and efficiency of banks, as well as the complexity of the regulation and the high costs of implementation could also pose a problem. Furthermore, the effectiveness of capital ratios is being contested. This is very problematic because capital ratios are one of the core devices used by the BCBS. Some argue that capital ratios are not being effective because it is common for banks to engage in regulatory arbitrage (Balthazar, 2006) (Ayadi, et al., 2012).

It is also argued that Basel III does not lay an even playing field as different types of banks will be impacted differently. A common theme in the criticism is that different bank business models will be impacted differently, with retail banks being affected the least and trading businesses being affected the most (McKinsey&Company, 2010). Provided that the regulatory requirements of Basel III are transversal to all banks, it is reasonable to assume that certain bank business models will adapt better than others because of their structure and overall strategy. The introduction of liquidity regulation in Basel III, namely the NSFR, will put pressure on the less-traditional liquidity structures. The impact will also be heterogeneous among models because the institutions that currently have low capital ratios could face larger difficulties raising capital (McKinsey&Company, 2010).

Against this backdrop, one of the efforts put forth by this thesis will be to understand the impact Basel III announcements had on different banking business-models. In line with the suggestion made by (Hryckiewicz & Kozlowski, 2017) and (Ayadi, et al., 2011), a "one-size-fits-all" type of regulation might be too generalist and does not address relevant risks within certain institutions. Likewise, the Basel regulatory framework might be imposing too strict requirements on certain business models.

This thesis is an effort at answering the following two questions:

Do the Basel III announcements have a negative impact on the firm value of European banks?

Do the Basel III announcements impact banks differently depending on the business model?

By researching the above questions, this thesis will try to understand if a one-size-fits-all regulatory framework is too generalist and if regulatory requirements should take into consideration the business models of banks.

The classification of business models will be executed based on the work done by (Hryckiewicz & Kozlowski, 2017). Their study identifies bank business models using a portfolio approach which consists of analyzing the balance sheet structure and categorize banks based on the combination of assets and liabilities. The categorization of earning assets and funding liabilities will be made in a traditional vs. non-traditional approach. The components of the asset side and liability side of the balance sheet will be classified as a ratio of loans to customers as a percentage of total earning assets and deposits as a percentage of total funding liabilities, which gives four possible business models. Table 1 shows the business models classification proposed. The classification exercise will be conducted using a cluster analysis similar to the one used in the study of (Hryckiewicz & Kozlowski, 2017).

Table 1.1 – Business model identification matrix

Cluster	Model	Asset Structure	Liability Funding Structure
C1	Model 1	Traditional Asset structure	Traditional funding structure
C2	Model 2	Non traditional asset structure	Traditional funding Structure
C3	Model 3	Traditional Assets	Non Traditional funding Structure
C4	Model 4	Non Traditional Asset Structure	Non Traditional funding Structure

Because of the central role banking institutions play in the real economy and the large economic and social costs associated with financial crises, the study of bank viability is relevant to understand the stability of the banking system during favorable and unfavorable economic periods. Because of the increased complexity and interconnectedness of banks today, more research is needed to understand the institutions of today. The importance to further study this topic is captured in (Hryckiewicz & Kozlowski, 2017) in the following quote:

"Given the large heterogeneity between recent banking business models, in fact, we know very little about the effect of banking models on bank profitability and risk."

Given the importance of credit intermediation in the real economy as well as other banking services, it is desirable to reduce the possibility of failure, especially in systemically important institutions, which could amplify the severity of the economic cycle.

2 - The Basel Committee of Banking Supervision and the Basel accords

The Basel Committee on Banking Supervision (BCBS) is the entity that publishes the Basel accords. The Basel accords are a set of banking regulation recommendations issued with the primary goal of improving financial stability by lowering the likelihood of failure and erasing potential competitive advantages in international banking arising from differences in regulation. Financial globalization is a current reality and therefore it becomes increasingly important the promotion and adoption of homogenous regulation through common agreements in order to remove any competitive inequalities that could arise from differences in national regulations.

The BCBS was initially comprised by the central bank governors of the G-10 nations but its intent since inception has always been for the regulations to be adopted by all regulators in countries that have banks with an international presence. In later amendments to the Basel accords, more specifically beginning in 1996, supervisors from non G-10 countries became involved in the drafting of the Basel accords (BCBS, 2016). Despite being only recommendations, the policies drafted in the Basel accords were adopted and enforced by most regulatory bodies in many countries. As of today, the Basel accords have been established since 1988 and nations and banks alike continue to make efforts to comply with its recommendations.

2.1 - Basel Regulation

2.1.1 - Basel I

The first Basel accord was made public through the publication called *"International convergence of capital measurement and capital standards"* in July 1988. The paper was written and agreed by all the G10 central bank governors. The accord was considered a success and a step in the right direction regarding regulation. The measures presented in the accord became widely accepted by all countries with active international banks by year-end 1992 (BCBS, 2016). It is important to note that the Basel Committee counts on the regulatory and enforcing bodies of each country to enforce the agreement. The committee does not have judicial power over any country and the regulations presented in the document are only suggestions. However, since the beginning, it was agreed that the 10 nations that designed the

accord would enforce it in their respective countries acting as role models for other nations. It was expected by the committee that many other national authorities that govern international banking institutions would follow suit and enforce Basel in their countries.

Basel I introduced many changes in the banking industry. Arguably, one of the most important contributions was the introduction of capital ratios and the criteria for the classification of capital in which it defined what constitutes Tier 1 and Tier 2 capital. It introduced the risk weighting system which imposed a minimum ratio of capital to risk-weighted assets, also known as target standard ratio of 8%, of which at least 4% needs to be comprised of Tier-1 capital. Tier 1 capital is high quality capital and it is comprised of paid-up share capital or common stock and disclosed reserves (BCBS, 1988). Tier 2 capital is comprised of Undisclosed reserves, asset revaluation reserves, general provisions/general loan-loss reserves, Hybrid (debt/equity) capital instruments and subordinated debt (BCBS, 1988). The riskiness classification of assets and their coverage ratios were grouped into five categories, 0%, 10%, 20%, 50%, and 100% to determine the capital adequacy ratio (BCBS, 1988). In appendix 1, it can be found the matrix for the risk weights by category taken from the Basel I accord. Basel I also included in the document the transition and implementation period and expectations.

Much of the criticism of Basel I stems from the fact that the framework only addresses credit risk and other risks inherent to the banking activity are not included such as operational risk, interest rate risk, etc. Later amendments were introduced after the first publication of Basel I to include other risks. For example, in January 1996 an amendment was issued altering the framework to include market risk (BCBS, 2016). In addition, the risk weight system has proven to not be bullet proof because institutions were able to engage into what is commonly called regulatory arbitrage (Ayadi, et al., 2012) (Balthazar, 2006).

2.1.2 - Basel II

The introduction of Basel II constituted a big change to the Basel framework. Basel II introduced the three-pillar system, which is also central to Basel III. The main objective of the accord and the BCBS remained static, which consisted of further strengthening the stability of the international banking system and eliminating potential competitive inequalities between internationally active banks. Financial regulation is a continuous process and it is expected that amendments and adaptations are introduced, so criticism is welcomed to devise yet better regulation. A good portion of Basel I was kept in Basel II. The minimum capital requirement of 8% introduced in Basel I is maintained. Also, there are not big changes in the

definition of capital. The calculation of the risk weighted assets (RWA) changed because of the introduction of operational risk into the formula.

As mentioned, the Basel II introduced the three pillar framework. Basel II framework is comprised of: Pillar I – Minimum Capital Requirements; Pillar II – supervisory review process; and Pillar III – Market discipline. The 3 pillars will be briefly described in the following subsections.

2.1.2.1 - Pilar I – Minimum Capital requirements

The first pillar under Basel II is the most extensive of the three. The first pillar defines and determines the minimum capital requirements banks must hold. This was an effort to further expand the rules set out in the first Basel accord (BCBS, 2016). The main aim of the Pillar I was to improve the capability of banks to foresee risks and improve their loss absorbency to withstand periods of financial stress. The definition of eligible regulatory capital remained the same as outlined in Basel I and the subsequent publication on the 27 of October 1998 (BCBS, 2004). The first pillar addressed three types of risk: Credit risk, operational risk, and market risk, which will be briefly described below.

2.1.2.1.1 - Credit risk

Basel II allows banks to choose between 3 methodologies for estimating credit requirements to cover credit risk. Banks can use the standardized approach, or the internal ratings based approach (IRB), or the advanced internal ratings based approach (BCBS, 2004). The difference between the standardized approach and the IRB approach is that the IRB allows banks to develop their own models for estimating probability of default. Under the advanced IRB approach, Basel allows banks to make their own estimations regarding probability of default, exposure at default, loss given default, and the maturity of the effective maturity. Supervisory approval is needed before banks can use the IRB approach or the advanced IRB approach.

2.1.2.1.2 - Credit risk, the standardized approach:

The standardized approach remains similar to what was introduced in the Basel I framework, in which the capital needed to cover credit risk will be determined by risk weights attributed to each asset exposure.

2.1.2.1.3 - Credit risk the internal ratings based approach (IRB):

The IRB approach is a method introduced in the Basel II accord and gives a higher degree of freedom to financial institutions to determine the required amount of capital needed to cover credit risk. Under the IRB method, there are four risk components to determine the risk weights to each asset. Probability of default (PD), Loss given default (LGD), Exposure at default (EAD), Effective maturity (M). The IRB approach can be further defined into basic IRB and advanced IRB. The difference between the IRB and the advanced IRB is based on the number of variables the banks can compute internally. While the standard IRB allows banks to determine the PD (Probability of default) under the advanced IRB, banks can determine all 4 variables (PD, LGD, EAD, M). However, the data needed to determine all the parameters is quite extensive, so supervisory authorization is needed. The justification for the introduction of the IRB is that banks have more information on the value of their assets, so they can make better judgments regarding the true riskiness of those assets. According to (Balthazar, 2006), recent research on credit risk management allowed more sophisticated banks to develop and handle risk reliably and better than the simpler Basel I capital requirement framework. However, not all institutions have the same level of sophistication, so it could happen that some institutions might not have the means to compute these variables internally. This can also be a disadvantage to the less sophisticated institutions as larger instructions under the advanced IRB approach could understate their risks and therefore needing less regulatory capital.

2.1.2.1.4 - Operational risk

The inclusion of minimum capital requirements to cover operational risk was a new addition to the Basel II framework. Operational risk is defined by the Basel II consultative paper from 2004 as follows: *"Operational risk is defined as the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. This definition includes legal risk, but excludes strategic and reputational risk."* (BCBS, 2004). Operational risk can result in large losses for an organization therefore it is appropriate to include operational risk in the Basel framework.

Under Basel II, three approaches are provided to calculate the amount of capital needed to cover operational risk with varying levels of sophistication. Banks that have a higher operational risk profile are expected to implement more advanced measures to calculate operational risk. Banks can also use varying methods for some parts of the business. Basel II includes the qualifying criteria to determine which approach each bank should use. The three

approaches by increasing level of complexity are: The Basic indicator approach, the standardized approach, and the advanced measurement approaches (AMA).

The basic indicator approach is the most basic indicator and according to the Basel II document it is described as follows:

"Banks using the Basic Indicator Approach must hold capital for operational risk equal to the average over the previous three years of a fixed percentage (denoted alpha) of positive annual gross income." (BCBS, 2004)

Under the standardized approach, the biggest difference between the basic indicator approach is that the standardized approach differentiates between business lines within the bank and assigns weights to each operational section. Crucially for this thesis, this could be seen as differentiating between business models, which is an argument that supports the assumption that business models have different risks and regulation should adapt to different strategies. However, its impact in this case is small because operational risk is a small portion of total regulatory capital. According to the Basel II document, the standardized approach can be described as follows:

"Within each business line, gross income is a broad indicator that serves as a proxy for the scale of business operations and thus the likely scale of operational risk exposure within each of these business lines. The capital charge for each business line is calculated by multiplying gross income by a factor (denoted beta) assigned to that business line. Beta serves as a proxy for the industry-wide relationship between the operational risk loss experience for a given business line and the aggregate level of gross income for that business line." (BCBS, 2004)

The advanced measurement approach (AMA) is the most advanced approach of the three as it allows banks to use their own internal operational risk models. Due to its complexity, it requires approval by national supervisors.

According to the Basel II document *"Under the AMA, the regulatory capital requirement will equal the risk measure generated by the bank's internal operational risk measurement system…""... Use of the AMA is subject to supervisory approval."* (BCBS, 2004)

2.1.2.1.5 - Market risk

The Basel II consultative paper defines market risk as follows:

"Market risk is defined as the risk of losses in on and off-balance-sheet positions arising from movements in market prices." (BCBS, 2006).

The market risk section in Basel II covers a varied number of topics related to trading and managing risk in the trading book. It provides guidance on appropriate valuation practices and methods for measuring market risk. The document presents the regulations and capital requirements for managing exposure from taking positions in interest rates, equities, foreign exchange, commodities, and options. The document outlines a section to each one of these asset classes. The agreement is essentially a guide for capital requirements and hedging rules for taking positions in these instruments. This will impose stricter rules on trading businesses of investment banks and the less sophisticated banks could be affected the most as they will have to develop stricter risk management methodologies compliant with the market risk section of Basel II. This can also mean that the more investment oriented banks could be at a disadvantage as they are subjected to these new rules.

2.1.2.2 - Pilar II – Supervisory review process

The supervisory review process pillar puts forth the idea that Basel regulation does not exist solely to ensure that banks have the adequate capital needed to cover their risks but also recognizes that management should bear responsibility for risk management practices. Bank management should take an active role in promoting the monitoring of risks within their organizations and designing better risk management systems. With this change in mentality, the BCBS expects bank management to take an active role in risk management and not solely comply with capital requirements imposed on them. The pillar also intends to promote the dialogue between bank management and regulators. This section of the accord also stresses the fact that the supervisory bodies should continuously evaluate banks and pay more attention to the banks that have bigger deficiencies. The pillar outlines four principles in the supervisory review process, which are include in appendix 1. (BCBS, 2006)

2.1.2.3 - Pilar III – Market discipline

The Pillar 3, market discipline, was also a new introduction to the Basel framework. BCBS describes the purpose of the third pillar as

"To complement the minimum capital requirements (Pillar 1) and the supervisory review process (Pillar 2). The committee aims to encourage market discipline by developing a set of disclosure requirements which will allow market participants to assess key pieces of infor-

mation on the scope of application, capital risk exposures, risk assessment processes, and hence the capital adequacy of the institution." (BCBS, 2006)

With this, the BCBS aims at improving the disclosure of information by institutions so it is easier to assess whether an institution is controlling its risks effectively and let market participants promote prudent behavior. According to the BCBS, pillar 3 wishes to achieve: *"Effective use of disclosure as a lever to strengthen market discipline and encourage sound banking practices."* (BCBS, 2016). It is expected for the market to promote "good behavior" and this way encourage bank management to act this way.

2.1.3 - Basel III

The Basel III accord is the latest accord released by the BCBS. It builds on the previous Basel accords and subsequent amendments published after. Basel III continues to improve around the 3 pillars introduced in Basel II. Advancements by Basel III include the strengthening of the capital ratios, more specifically the increase of Tier 1 ratio from 2% to 4.5%, enhancing risk coverage, and the introduction of 2 liquidity ratios. The phase-in schedule with the new capital requirements can be consulted in appendix 1. Liquidity requirements were not present in the previous accords, so this introduction is one of the fundamental changes from the previous publications (BCBS, 2010). The introduction of liquidity ratios was extensively discussed and published by the BCBS in the years leading up to the Basel III release, so its inclusion came to no surprise. The new liquidity ratios introduced in Basel III are the LCR (Liquidity Coverage Ratio) and the NSFR (Net Stable Funding Ratio).

With the introduction of the liquidity coverage ratio the Basel Committee tries to define the qualification of liquid assets, so that bank's assets remain liquid even during periods of economic stress. The introduction of the liquidity ratios in Basel III can be attributed, to a certain extent, to the liquidity drought experienced during the subprime crisis, more specifically following the bankruptcy of Lehman. After a thorough analysis, the committee found that banks did not have adequate practices regarding liquidity management which exacerbated the problem. Upon this assessment, the Committee found it necessary to include liquidity standards into the framework. The Committee also revised the definition of qualifying liquid assets subject to the overall requirement that such assets remain prudently liquid in periods of stress. The optimal level of liquid assets that banks should hold in the balance sheet is still an open discussion. (Bordeleau & Graham, 2010) make the case that banks profitability can be

improved by holding liquid assets to a certain level, though with diminishing returns, as at a certain point the gains halt.

By introducing liquidity standards, the Committee intends to achieve two objectives. According to the Basel III consultative document, the first objective reads as follows: *"Promote short-term resilience of a bank's liquidity risk profile by ensuring that it has sufficient high-quality liquid assets."* (BCBS, 2010) This first objective is intended to be accomplished through the introduction of the LCR. The second objective is defined by the BCBS as follows: *"Promote resilience over a longer time horizon by creating additional incentives for banks to fund their activities with more stable sources of funding on an ongoing basis."* (BCBS, 2010) This second objective is intended to be achieved through the NSFR.

The goal of the LCR is to ensure that banks have the adequate level of high-quality liquid assets (HQLA) so that they can survive a liquidity stress scenario lasting 30 days (BCBS, 2010).

Equation 2.3.1.1 – LCR (BCBS, 2010)

$$100\% \leq \frac{HQLA}{Total\ net\ cash\ outflow\ over\ the\ next\ 30\ days}$$

The introduction of the LCR was made on the first day of January of 2015 but its implementation will be gradual to ensure that there is no abrupt disruption to banks operations. The minimum LCR requirements will be phased in as follows (BCBS, 2013):

Table 2.3.1.1 - Phase-in introduction of the LCR (BCBS, 2013)

	2015	2016	2017	2018	2019
Minimum LCR requirement:	60%	70%	80%	90%	100%

The NSFR was developed to promote medium- and long-term stable funding of banks and is an effort to limit the over reliance on short term funding sources such as wholesale funding. The NSFR is a ratio that *"establishes a minimum acceptable amount of stable funding based on liquidity characteristics of an institution's assets and activities over a one year horizon"* (BCBS, 2010). The NSFR can be defined as the ratio that determines the amount of

stable funding available to an institution in relation to its required amount of funding. The ratio should always be maintained above 100%. The NSFR formula is included below (BCBS, 2010):

Equation 2.3.1.2 - NSFR

$$100\% \leq \frac{Available\ amount\ of\ stable\ funding}{Required\ amount\ of\ stable\ funding}$$

The NSFR has proven to be difficult to implement, as of 2017 it is still being fine-tuned. A press release from the 6 of October of 2017 by the BCBS allows national regulatory bodies discretion for the treatment of derivative liabilities. The standard factor proposed by Basel III is 20% of derivative liabilities. The BCBS allowed for this factor to be lowered down to 5% (BCBS, 2017).

3 - Literature review

The following section examines the academic literature on bank regulation, event studies and bank business models.

3.1 - Bank business models, identification methods and results.

This part of the thesis is devoted to reviewing the current literature regarding banking business models. This section includes an overview of the different methods used to classify business models as well as their findings. To summarize, the majority of studies reviewed in this section reach the conclusion that traditional forms of banking are more stable and less risky. These findings could have implications for regulation because all banks under Basel III are subject to the same capital and liquidity requirements.

One obstacle when assigning business models to banks is that there is not a universally agreed standard procedure in academic literature. Each author follows its own definition

and criteria to better fit their study. Classifying banks can be useful for several purposes such as consistency among studies and a potential application in regulation. Banks diverge among each other significantly in many aspects. The variables that receive the most attention when differentiating bank strategies are funding strategies, asset composition, capitalization levels, income generating strategies (income vs. non-income), and ownership structure. Different types of banks have different risks inherent to their activity. However, some regulation is still written in a one-size-fits-all approach. Some authors suggest that taking business models into consideration when devising regulatory standards can bring added benefits to regulation (Ayadi, et al., 2012) (Hryckiewicz & Kozlowski, 2017) (Mergaerts & Vennet, 2016).

Regulators already recognize the importance of business models in managing the sustainability of the banks. Starting at year end 2015, the ECB started conducting a forward-looking evaluation of activities of banks and conducting a review called the SREP, short for Supervisory Review and Evaluation Process. The ECB does an analysis on the sustainability of the strategy of every bank and sends them a report with recommendations (ECB, 2016). The course that regulation is taking in recent years suggests that more attention will be given to the business models of banks in the future. (Mergaerts & Vennet, 2016) share this opinion which is captured in the following quote from their study:

"…These considerations imply that the application of prudential regulation should also reflect the heterogeneity of bank business model decisions. In this regard, supervisors are increasingly aware that business models matter for banks' risk-return profiles. In the future, the Supervisory Review and Evaluation Process (SREP) published by the European Banking Authority (EBA, 2014) will become the cornerstone of European bank supervision."

Cluster analysis is one method that can be used to classify bank business models. (Ayadi, et al., 2011) identified three business models based on the balance sheet structure using the Ward (1963) hierarchical clustering algorithm and the pseudo-F index to determine the number of clusters in the data. The three models identified by the authors were retail banks, investment banks and wholesale banks. They found that traditional banking business models, those that rely on customer deposits for funding and customer lending activity on the asset side of the balance sheet, are the least leveraged, are more stable during financial crisis and are less risky and performed relatively well. This conclusion is also supported by the studies of (Hryckiewicz & Kozlowski, 2017), (Altunbas, et al., 2011) and (Mergaerts & Vennet, 2016). (Ayadi, et al., 2011) also concluded that wholesale banks fared worse in terms of profitability and are the riskiest due to low liquid assets and high volume of interbank

funding. They also concluded that banks making up the investment model also rely on less stable funding and maintain low levels of loss-absorbing capital.

(Mergaerts & Vennet, 2016) borrowed methods from various studies to assign business models to the banks in their sample. Apart from financial variables that can be retrieved from the balance sheet and income statements, they believe that other variables such as types of clients, products and distribution channels should be taken into consideration. The authors used both direct and indirect classifications in their research. Direct classification are classifications given by a third party (e.g. Bankscope), and indirect classifications use financial variables to compute and determine business models, (e.g. Cluster analysis). The authors recognize that each method has its flaws. Therefore they use multiple methods to assign business models. One of the main conclusions from this study is that traditional banks have better long-term performance than non-traditional banks.

(Hryckiewicz & Kozlowski, 2017) used the k-medoid cluster analysis to classify bank business models. K-medoid cluster algorithm identifies clusters in the data by solving for the smallest Euclidian distance between variable points in the data. The clusters are actual data points in the sample, this way reducing the effect of outliers. The authors found 4 distinct business models, two within a traditional structure and two in a non-traditional structure. They argue that traditional banks are less systemically risky than non-traditional business models. They show that the riskiest business model in their sample was the investment bank model due to its low ratio of deposits on the liability portion of the balance sheet as the liability structure of banks is the main driver of systemic risk (Hryckiewicz & Kozlowski, 2017). If many banks have extensive short-term funding and the interest rate increases due to market illiquidity, this can seriously increase funding costs for these institutions. Further, according to their study, bank interconnectedness exacerbated the problem during the financial crisis. As the current trend is for banks to become increasingly connected, this problem is not likely to disappear soon. (van Oordt & Zhou, 2014) also reached the same conclusion in their study regarding systemic risk. Systemic risk, they argue, is composed of bank specific tail risk and interconnectedness.

In a different study, (Altunbas, et al., 2011) reached the conclusion that a stronger customer deposit base is more effective at reducing bank distress. This result is stronger for riskier institutions. A market base type funding is correlated with higher likelihood of distress. The authors argue that banks with higher capital ratios have a better trade-off between risk

and profitability. They also argue that banks with a larger deposit base decrease interest expense and increase interest income. Banks that have a more traditional balance sheet, which means more customer deposits as funding and more loans as assets, have more tail risk but less exposure to systemic risk. This can be explained by the lower reliance on short-term funding which could substantially increase their funding costs during periods of liquidity scarcity. This conclusion is similar with (Hryckiewicz & Kozlowski, 2017), quoting their study:

"Systemic risk is related to bank funding structure and individual risk seems to be linked to it's asset structure."

(Beltratti & Stulz, 2012) investigated why banks performed so poorly during the financial crisis. In agreement with the other research studies present in this section, they found that banks that relied on short-term funding performed poorly during the crisis. Their study showed that banks that had more Tier-1 capital and relied on deposits for funding performed better during the crisis.

From this brief academic review, the consensus seems to indicate that a traditional structure seems to be linked to bank stability and to a better risk return profile. The funding structure seems to be an important variable for stability while the asset side of the balance sheet is important to ensure the bank is financially healthy. Upon the revision of these studies one common theme seems to take form, which is that traditional forms of banking seem to be more stable than less traditional forms of banking. This common theme is the reason behind the classification of banks in this study. This study assigns two variables to each bank in the sample: percentage of loans to customers of total earning assets and percentage of deposits of total funding liabilities. With these two variables, a cluster algorithm is used to differentiate between traditional and non-traditional models. The full description of the methodology used will be further discussed in the methodology section.

3.2 - Literature review of the efficient market hypothesis (EMH) and event studies

One method available to conduct an assessment on the impact of Basel III will have on banks is by conducting an event study to capture the market reaction to the announcement concerning Basel III. To conduct an event study, the assumption of efficient markets is neces-

sary. According to the efficient market hypothesis (EMH) developed by Professor Eugene Fama, a market is said to be efficient if security prices reflect all available information and therefore it is not possible for traders to consistently profit on this information in the long-run (Fama, 1970).

According to the EMH, there are 3 forms of market efficiency. Weak-form efficiency, semi-strong form efficiency, and strong-form efficiency. Weak-form efficiency states that traders cannot earn excess returns based on the analysis of past prices. The semi-strong-form efficiency is based on the idea that the market quickly incorporates all available public information, so it is not possible for traders to profit by acting on this information. The strong-form efficiency is the idea that market prices reflect all public and private information (Fama, 1970).

The EMH does not go without critics. For example, (Jegadeesh & Titman, 1993), argue that a portfolio consisting of buying recent winner and selling recent losers will yield a positive return. In their own words, *"trading strategies that buy past winners and sell past losers realize significant abnormal returns over 1965 to 1989 period"* (Jegadeesh & Titman, 1993). This study goes against the weak-form market efficiency theory which argues that profits cannot be constantly made based on decisions made based on past prices. (De Bondt & Thaler, 1985) challenge the hypothesis of semi-strong form efficiency by showing that a "contrarian" portfolio building approach can yield positive returns. Their research stems from the idea that people tend to overreact to news and the same can be applied to the stock market. They concluded in their study in 1985 that *"consistent with the predictions of the overreaction hypothesis, portfolios of prior losers are found to outperform prior winners"* (De Bondt & Thaler, 1985). Another issue to keep in mind is that information asymmetries might be present in thinly traded stocks which could result in mispriced securities.

Despite the criticism of Fama's EMH theory, this study assumes the market is semi-strong efficient. Given this assumption, an event study can provide insight regarding the wealth effects caused by the introduction of Basel III. (Eyssell & Arshadi, 1990) and (Copper, et al., 1991) conducted event studies on the announcements of Basel I. Both studies concluded that the market reacted adversely to the announcement of the Basel I accord, which is an indication that market participants expect lower bank returns in the future with the implementation of new capital requirements introduced in 1988. This does not mean that future reac-

tions to new iterations of the Basel accord will be negative. Basel III, for instance, is a more comprehensive accord than Basel I.

3.3 - Bank profitability and the impact of Basel

Understanding bank profitability is important not just for shareholders, credit providers, and bank managers, but also for financial regulators. Regulation can have an impact on the profitability and of financial institutions and such issues should be looked at because financially healthy banks can contribute to the stability of the banking industry. Furthermore, if banks are profitable, they can build up capital ratios with less effort, which is a desirable outcome by regulators. Inversely, if banks have losses, this can eat up capital making it harder for banks to comply with regulatory capital requirements.

3.3.1 - General bank profitability

There are many variables that can influence bank profitability. It could prove useful to understand these variables and dynamics. A common and widely accepted predictor of bank profitability is GDP. (Gambacorta & Albertazzi, 2009) concluded that banks' profits are procylical, as profits are positively correlated with GDP. They justify their finding by explaining that income is affected by a growing economy via increased interest income and the quality of the strengthening of the credit portfolio. This conclusion is intuitive because due to the better economic conditions there could be less defaults on loans outstanding and therefore loan loss provisions are reduced. The preceding conclusion is important when testing for bank performance as this macroeconomic variable should be controlled for when testing for profitability (Athanasoglou, et al., 2008). When analyzing bank performance, it should be noted the economic context in which profits were made.

(Molyneux & Thornton, 1992) tested several variables against bank profitability. These researchers found a statistically significant correlation between European banks return on capital and concentration. They also found a positive correlation between return on capital and nominal interest rates which, according to the authors, can be understood as a capital scarcity proxy. (Molyneux & Thornton, 1992) found a positive relationship between government ownership and return on capital, which was not an expected conclusion as it goes

against the conventional belief that government run enterprises fair worse than privately run ones. Challenging the previous conclusion, (Athanasoglou, et al., 2008) find that ownership structure is not a good predictor of bank profitability. Another conclusion also reached by (Molyneux & Thornton, 1992) emphasize the importance of operational expenses when explaining bank performance, making the case for the importance of managerial expertise when explaining bank profitability. Understanding bank profitability is a complex topic and as showed by these studies, there are several variables that can explain bank profitability and there is not a wide consensus on the results.

Although most of these variables will not be the scope of this thesis, it is relevant to note that extensive studies regarding bank profitability have been conducted and many potential variables other than capital and liquidity standards can impact profitability.

3.3.2 - Impact of Basel on the Real Economy

(Cosimano & Hakura, 2011) and (Angelini, et al., 2011) argue that the Basel regulations will impact the real economy through reduced loans underwritten by banks and increased interest rates. (Cosimano & Hakura, 2011) argue that Basel III will result in the world's largest banks to increase their lending rate by an average of 0.16% which would in turn reduce loan growth by 1.3%. This increase was based on the assumption that these banks will need to increase, on average, their equity-to-asset ratio by 1.3% to achieve the equity to comply with new Basel III risk-weighted asset ratios. Provided the banks in their sample will pay higher financing costs than if they were financed through debt, they concluded that the Modigliani and Miller assumptions did not apply for the sample of banks in their study. In addition, they show that maintaining an estimated elasticity of loan demand with respect to the loan rate of 0.33% for the group of largest banks, loan growth will decline by 1.3% in the long run, and thus could negatively impact the real economy (Cosimano & Hakura, 2011).

However, not everyone is of the same opinion about the negative impacts of Basel III. (Admati, et al., 2013) defends the idea that increased equity requirements for banks will not have adverse impacts. (Admati, et al., 2013) defend the idea that equity is not expensive for banks and better capitalized banks can bring large benefits both for the banking institutions and for the economy. Other researchers such as (Berger & Bowman, 2013) also argue that higher capital enhances the capacity of institutions to absorb financial shocks and could even have a positive effect on ROE.

3.3.3 - Impact of Basel regulation on Bank Profitability. Do better capitalized banks have better profitability?

Basel accords are based on the notion that banks should be better capitalized to better withstand turbulent periods and maintain stability. Better capitalized banks will be more resilient to financial stress, there is not much resistance against this assumption. The bigger question today is centered on whether regulatory capital requirements costs will outweigh the benefits. For example, issues such as regulatory arbitrage being prevalent should be taken into consideration otherwise it defeats the purpose of applying capital requirements (Ayadi, et al., 2012). Popular believe would make us think that holding more capital translates in costs for banks however, studies like (Berger & Bowman, 2013) support the efforts undertaken by Basel. They reach the conclusion that holding more capital translates in higher survival probabilities during a crisis. Further, and perhaps surprisingly, they also concluded that higher capital enhances ROE of small banks during all period of the economic cycle while it enhances ROE for medium and large size banks during bank crisis and market crisis (Berger & Bowman, 2013). Other studies such as (Altunbas, et al., 2011) would agree with the higher survival probability conclusion as they argue that undercapitalization was one of the explanations for the severity of the financial crisis of 2007. (Athanasoglou, et al., 2008) also find that capital and credit risk are important variables when explaining bank profitability. These studies could be interpreted as strong arguments supporting the measures proposed in the Basel regulations.

On the other hand, (Eyssell & Arshadi, 1990) and (Copper, et al., 1991) conducted event studies on the announcements of Basel I with the opposite conclusion. The announcement had a negative impact on the stock returns which could mean the banks in the sample will generate lower returns in the future.

(Demirguc-Kunt, et al., 2010) study is an effort to understand if market participants favored better capitalized banks by measuring stock returns. They concluded that stock returns were not affected by differences in risk adjusted capital ratios between banks during stable economic periods. However, during the crisis, the stock returns of large banks were more sensitive to the leverage ratio than the risk adjusted capital ratio. One explanation could be that market participants understand that capital requirements can be easily manipulated by financial institutions, a phenomenon called regulatory arbitrage. This could also be explained by the conclusions by (Hryckiewicz & Kozlowski, 2017) and (Altunbas, et al., 2011) that

market base type funding is correlated with higher likelihood of distress. There was also an association with higher quality Tier 1 capital and stock returns, which shows that market participants value better quality capital buffers (Demirguc-Kunt, et al., 2010).This conclusion supports the efforts towards better capital requirements and the introduction of leverage ratios. According to the study, these measures could help banks during periods of financial stress. This can also be an argument of the introduction of the counter cyclical capital buffer in Basel III.

3.3.5 - How liquidity ratios impact profitability

(Bordeleau & Graham, 2010) find that profitability is improved for banks that hold a certain level of liquid assets, however the gains can be reversed if the amount of liquid assets increases past a certain threshold. It can be beneficial to hold highly liquid assets but only to a certain extent. According to the authors:

"... the opportunity cost of holding low-return assets eventually outweighs the benefit of any increase in the bank's liquidity resiliency as perceived by the funding markets."

The question is now centered in how much liquid assets the banks should hold. It turns out that this ratio is not simple to determine, as the relationship between liquid assets and profitability depends on the bank business model (Bordeleau & Graham, 2010). They argue that traditional bank business models, comprised mostly of deposit and loans, optimize profits with lower levels of liquid assets. On the other hand, less traditional banking models, more specifically banks that engage in more market related activities, benefit more by holding more liquid assets (Bordeleau & Graham, 2010). Their study suggests the need to adjust liquidity ratios based on the activity of each bank. On the other hand, (Mergaerts & Vennet, 2016) reached the conclusion that a high NSFR reduces the profitability of non-traditional banks and increases the stability of more retail oriented banks.

(Molyneux & Thornton, 1992) stated the following in their study:

"In the case of liquidity ratios, we find a weak inverse relationship with profitability which is also to be expected as liquidity holdings (particularly those imposed by the authorities) represent a cost to the bank"

According to (Molyneux & Thornton, 1992) the introduction of the LCR and NSFR will have a negative impact in the value of the banks, however a weak impact.

4 - Methodology and results

4.1 - Sample selection

The sample in this study is comprised of exchange traded European banks. The sample was selected by retrieving data from the list of European banks from the Thompson Reuters Eikon database. The balance sheet data was also retrieved from Reuters Eikon and was used to analyze and assign a business model to each bank in the sample. The total return for all European bank stocks was retrieved to conduct the event study. The total return values retrieved take into account past dividends. After the initial extraction of the data, the sample was then narrowed down to accommodate for data availability. The final sample includes 173 European banks in 2010. The list of banks in the sample can be consulted in appendix 2.

4.2 - Banks business models' methodology and result

The k-means clustering algorithm was used to identify and assign business models to each bank. The k-means clustering method consists of clustering data points by minimizing the squared Euclidean distance between sample variables. Applying clustering methodology to identify bank business models has been previously done by (Hryckiewicz & Kozlowski, 2017), (Ayadi, et al., 2011), (Ayadi, et al., 2012) and (Roengpitya, et al., 2014). However, the clustering methods used by these studies differ between each other. (Hryckiewicz & Kozlowski, 2017) used the k-medoid algorithm with euclidean distance. (Ayadi, et al., 2011), (Ayadi, et al., 2012), and (Roengpitya, et al., 2014) on the other hand used a hierarchical clustering method to identify bank business models in their data. These authors used the Ward's linkage clustering method and the Carlinsky Harabasz pseudo-F index to determine the number of clusters.

This study used the k-means clustering algorithm, so the focus will be on this method. The k-means clustering method is similar to the k-medoid method used by (Hryckiewicz & Kozlowski, 2017). The difference between these two methods is that the k-medoid clustering algorithm uses actual data points in the sample as the clusters while the k-means cluster is a result of the average of the data points in the cluster. According to (Hryckiewicz & Kozlowski, 2017), k-medoid is a more robust clustering method as the cluster is an actual

existing point in the sample and therefore the result is less prone to the effect of outliers. The present study uses k-means due to data limitations.

The formula for the k-means algorithms is as follows:

Equation 4.2.1 – K-Means clustering algorithm Where J is the objective function, k is the number of clusters, n is the number of cases, c is the centroid for cluster j

$$J = \sum_{j=1}^{k} \sum_{i=1}^{n} \left\| x_i^{(j)} - c_j \right\|^2$$

The distinction between banking business models is based on the balance sheet composition of each bank, as in (Hryckiewicz & Kozlowski, 2017). To accomplish this, balance sheet data was retrieved to identify all the lines that comprised the earning assets and funding liabilities for each bank. To determine the asset structure of each bank, the ratio of loans to entities other than banks to total earning assets was calculated. Similarly, for the liability structure, the ratio of deposits to total funding liabilities was calculated.

Equation 4.2.2 - Ratio of loans to entities other than banks to total earning assets:

$$Asset\ Structure = \frac{Loans\ to\ entities\ other\ than\ banks}{Total\ earning\ assets}$$

Equation 4.2.3 - Ratio of deposits to total funding liabilities

$$Liabilities\ Structure = \frac{Deposits}{Total\ funding\ liabilities}$$

By measuring these variables, it can be inferred the type of banking activity each bank engages in, i.e., whether it is more traditional or non-traditional. Each bank in the sample has these two variables assigned. Graph 4.2.1 shows a 2D graph with the sample distribution.

The analysis in this study is different from that of (Hryckiewicz & Kozlowski, 2017) in four points. First, their study combines deposits and short-term funding into one variable while in this study they are considered two distinct variables. Second, (Hryckiewicz & Kozlowski, 2017) include non-interest liabilities as a funding variable while this study omits

that variable because that variable was not present in the data collected. Three, this study categorizes banks using a traditional vs non-traditional approach while (Hryckiewicz & Kozlowski, 2017) uses more balance sheet variables as inputs in the clustering algorithm. And forth, this study uses the k-means clustering algorithm while (Hryckiewicz & Kozlowski, 2017) used the k-medoid clustering algorithm.

Limitations in this study include the fact that the sample only includes publicly listed banks. A second limitation is that the Thomson Reuters Eikon database only includes banks that are still operating as of 2017. Because of this, the study suffers from survivorship bias. The composition of banking business models in a specific year should be interpreted as the evolution of the current surviving banks and not the full profile of banking business models in that specific year.

The computation of clusters was done using Matlab. The algorithm used was k-means with four clusters and squared Euclidean distance and 200 replicates. The k-means algorithm starts at random points, for this reason it was important to use many replicates in order to have consistent cluster results. Table 4.2.1 shows the business models identified and Table 4.2.2 shows the cluster point, or centroids, obtained by running the k-means algorithm on data from 2010. Graph 4.2.2 shows the sample distribution graph where the centroids are marked with an X. Four business models were identified. Model 1, Model 2, Model 3, Model 4.

Model 1 consists mainly of traditional assets and has a traditional funding structure. Model 2 composition is mainly of non-traditional assets and has a traditional funding structure. Model 3 Consists mainly of traditional assets and has a non-traditional funding structure. Model 4 Consists mainly of non-traditional assets and has a non-traditional funding structure. In appendix 2 it is included the table with the list of banks and the assigned business model.

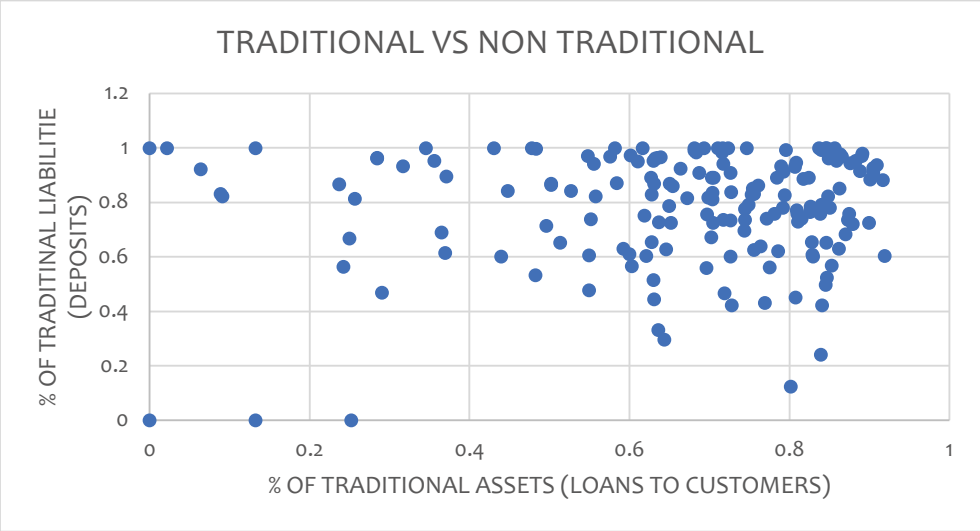
Table 4.2.1 – Bank business models identified

Cluster	Model	Model name	Asset Structure	Liability Funding Structure
C1	Model 1	T/T	Traditional Asset structure	Traditional funding structure
C2	Model 2	NT/T	Non traditional asset structure	Traditional funding Structure
C3	Model 3	T/NT	Traditional Assets	Non Traditional funding Structure
C4	Model 4	NT/NT	Non Traditional Asset Structure	Non Traditional funding Structure

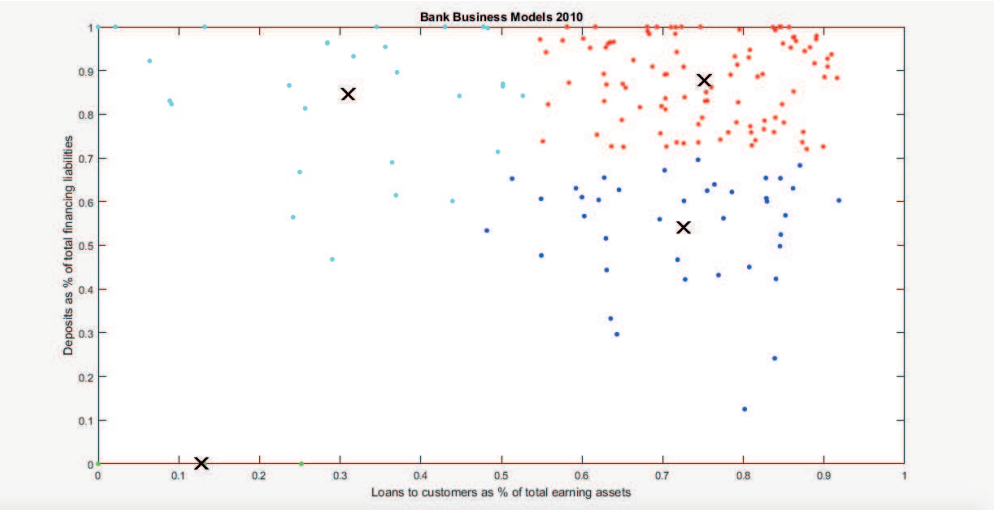
Table 4.2.2 – Cluster points, or centroids, based on the 2010 year-end balance sheet data.

Model	% Traditional assets	% Traditional liabilities
Model 1	0.7516	0.8782
Model 2	0.3095	0.8464
Model 3	0.7256	0.5414
Model 4	0.1280	0

Graph 4.2.1 – Illustration of the sample distribution. It depicts the percentage of traditional assets and percentage of traditional liabilities for each bank in the sample in 2010. The X-axis represents the percentage of loans to customers of total earning assets. The Y-axis represents the percentage of deposits of total funding liabilities.



Graph 4.2.2 – Result obtained after running the k-means algorithm on balance sheet data from 2010. The X's represent the clusters also called centroids.



4.3 - Event study methodology and results

4.3.1 - Introduction

According to (MacKinley, 1997)*"using financial market data, an event study measures the impact of a specific event on the value of a firm."* According to (Kothari & Warner, 2007), event studies are useful because the magnitude of the abnormal returns can be a good indicator of the impact the announcement had on the return of the security, and therefore on the wealth effects on the firm. This research conducts an event study to assess the wealth impact of various Basel III announcements on European banks. Event studies can be used as alternatives to analysis based on accounting methods which can suffer from data accuracy (McWilliams & Siegel, 1997). Compared with accounting methods, event studies can be simpler to compute and retrieve data and erase the possibility of accounting information being manipulated, (McWilliams & Siegel, 1997).

For an event study to be robust, several assumptions should be made. According to (McWilliams & Siegel, 1997), three assumptions should be met to design a robust event study. The first assumption is market efficiency. This assumption is based on Eugene Fama's efficient market hypothesis and it assumes that market participants immediately take into account information released into the market, therefore stock prices are immediately adjusted. This is discussed in the literature review section above regarding the EMH. The second assumption is that the event was unanticipated. This means that market participants did not know in advance the contents of the event. This assumption is hard to make, given that it is hard to assess the extent of information leakage before the announcement. Also, it is impossible to measure the degree to which market participants knew, or expected, the modifications announced. It is usually assumed that if no big price movements occur during the days preceding the event announcement, then we can infer that the event was unanticipated. The third assumption is confounding effects. This important assumption means that the effects on the stock prices are only due to the event under study and not due to other events that are taking place simultaneously. This is one of the reasons why event studies with short time windows are more robust as they isolate the effects of the announcement and avoid potential contamination of other announcements with material information released around the same time. The present study uses daily returns because this way abnormal returns can be measured more precisely (Kothari & Warner, 2007). If the time window is larger, we are assuming that markets are not efficient, meaning that market participants take longer to incorporate new information into stock prices, increasing the possibility that a different event is contaminating our

event study. According to (Kothari & Warner, 2007), more confidence can be placed in short-horizon tests than long-horizon.

In this thesis, the time windows used are [0], [-1,+1] and [-3,+3]. The [0] time window only considers stock price movements on the day of the event. The [-1,+1] event window considers stock price movements the day preceding the event, the event day and the following day, giving more time for market participants to assimilate the information. Similarly, the [-3,+3] event window include 3 days before the event, the event day and three day after the event date, providing an even larger amount of time for market participants to assess the full extent and repercussion of the information contained in the announcement. The larger event windows have the benefit of considering the days preceding the event to capture any potential information leakage and gives traders more time to incorporate the information into the pricing. This can be a desired characteristic because some academics believe that stock prices can overreact to announcements, as showed for example in (Chopra, et al., 1992).

4.3.2 - Event dates

The dates chosen to assess the Basel III impact were the following:

Event	Date	Description
Event 1	30 March 2009	"Initiatives in response to the crisis by the Basel Committee"
Event 2	17 Dec 2009	"Consultative proposals to strengthen the resilience of the banking sector announced by the Basel Committee."
Event 3	16 July 2010	"Progress on regulatory reform package: Basel committee press release." Introduction of the countercyclical capital buffer proposal
Event 4	26 July 2010	"The Group of Governors and Heads of Supervision reach broad agreement on Basel Committee capital and liquidity reform package."
Event 5	12 Sep 2010	"Group of governors and Head of Supervision announces higher global minimum capital standards"
Event 6	16 Dec 2010	Basel III full rules text document with the new framework to be fully adopted by Jan 2019 released

A brief summary of the announcements are described.

30 March 2009:

On the 30 of March 2009, the BCBS issued a press release in which it expressed the interest of the BCBS in expanding the current Basel II framework and make it more resilient considering the recent events brought by the crisis. The ideas put forth by the head of the BCBS to include in the regulatory framework are:

- More and higher quality capital requirements,
- Include requirements regarding trading book, securitization and derivatives.
- The introduction of a countercyclical capital buffer
- Liquidity buffers
- Better governance standards
- Greater transparency in banks portfolios.

This new focus was sure to bring dramatic changes to the banking landscape and it could be argued that non-traditional banks were to be hit the hardest because a great deal of regulation was designed to put pressure on the trading book, securitization business, OTC derivatives, and funding sources motivated by the crisis of 2007. It is important to mention that no specific or quantifiable measures were presented, this was only an announcement that the BCBS will work towards implementing regulation in these areas.

17 of December 2009:

On the press release of 17th of December 2009, the BCBS communicated that during the meeting of 8 and 9 of December of 2009 they approved for consultation a package of proposals to strengthen global capital and liquidity regulations. According to the press release, the consultation package was designed taking into consideration the lessons from the financial crisis and with the objective to promote a more resilient banking sector. The two documents comprising the consultation package are entitled *"International framework for liquidity risk measurement, standards and monitoring – consultative document"* and *"Strengthening the resilience of the banking sector – consultative document."* The documents were only proposals and were still to be debated and approved, but they represented the main brushstrokes of what was to become Basel III. This press release is also significant because it further pushed for reforms in the trading businesses as it introduced rules for the trading book and increased capital requirements for exposures arising from derivatives and repo transac-

tions to incentivize OTC derivatives to move into the exchanges. The document also introduced operational risk reforms. One of the big announcements in the press release was the announcement of the inclusion of liquidity reforms (the LCR and the NSFR), which further consolidated the interest of the BCBS to integrate liquidity regulation and monitoring into the Basel framework. Regarding liquidity, the committee justifies their position by arguing that during the 2007 crisis many banks were not able to maintain adequate liquidity and this being a cause for the severity of the liquidity drought that occurred during the financial crisis. Quoting the announcement *"The crises illustrated how quickly and severely liquidity risks can crystallize and certain sources of funding can evaporate, compounding concerns related to the valuation of assets and capital adequacy"* (BCBS, 2009). This press release will be relevant to assess the wealth effects not just of the initial Basel III framework but also the fully drafted introduction of the liquidity ratios. These documents were the first that introduced the LCR and the NSFR ratios as liquidity metrics. It is also expected that trading businesses and therefore the banks with less traditional business models will be affected the most due to the introduction of rules regarding the trading book and strengthening of capital requirements regarding derivative exposures.

16 July 2010:

On the 16 of July of 2010 the BCBS announced that the Basel III development was on track and introduced a new capital requirement, the countercyclical capital buffer. This was a new capital buffer on top on previously introduced capital requirements. This could pose additional capital burden for banks. Assessing the wealth impact of this announcement could provide insight into the wealth effect the additional capital buffer will have.

26 July 2010:

On the 26 of July 2010 the Governors and Heads of supervision reached a broad agreement regarding the capital and liquidity reform package. The main topics agreed on were the definition of capital, the treatment of counterparty risk, the leverage ratio, and the global liquidity standard. Some calibration and phase-in arrangements were still to be agreed upon in September. This could be seen as the decisive step to adopt the main Basel III framework proposed. Minor alterations and specific details were still to be communicated.

12 September 2010:

On the 12 of September of 2010, the BCBS released an announcement that reads that the Group governors and Heads of Supervision announced a revision and a substantial strengthening of the minimum capital standards. The BCBS announced that it fully endorsed the agreement reached on 26 of July 2010. The announcement was specific with respect to the increase of capital requirements and the phase-in projections. The matrix with the new framework and implementation projections is included in appendix 1. In summary, the new agreed reforms would increase the minimum common equity requirements from 2% to 4.5% in 2015 and beyond. The capital conservation buffer, a mandatory requirement to withstand periods of economic stress, will be introduced in 2016 at 0.625% and it will be raised gradually up to 2.5% in 2019. The minimum tier-1 capital will be raised up from the current in 2010 of 4% to 6% in 2019 (BCBS, 2010). This announcement is also a confirmation of the introduction of liquidity standards in the Basel III accord and the exact timeline of implementation was provided.

16 December 2010

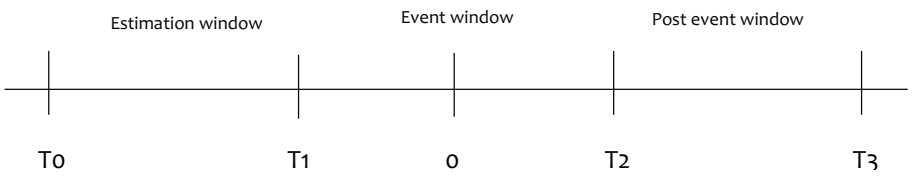
On 16 December 2010 the BCBS issued two documents: "Basel III: A global regulatory framework for more resilient banks and banking systems" and "Basel III: International framework for liquidity measurement, standards and monitoring." These two documents are the rules text of the Basel III framework to be fully implemented by 1 January 2019. This publication was the actual document that holistically introduced the Basel III regulation framework where all the details became known.

4.3.3 - Event study methodology

The objective of this thesis is to examine the return behavior of firms around an event date (in this case, announcements regarding Basel III) and investigate if indeed the announcement caused a price swing larger than expected. To do that, an expected return of a particular stock at a specific date is calculated. There are several methods for computing the expected return of a security. The most widely used method in event studies is the market model which will be discussed in this section. By using the market model to estimate the return of a security, the returns of that security will need be regressed with the returns of a mar-

ket portfolio over the estimation window. Taking into consideration that this study is using only European banks, the market portfolio used was the index Eurostoxx 600. (McWilliams & Siegel, 1997) suggest regressing the stock returns with the market portfolio between 50 and 250 days trailing the event window. In this study, 250 trading days trailing the event window were used, so the estimation window is 250 days. The event window will vary depending on the window used, this study uses [0], [-1,+1] and [-3,+3] windows. The post event window will not be used in this study. The regression will provide the intercept (alpha) and the slope of the function (beta) of the stock in relation to the market portfolio. Beta can also be interpreted as the riskiness of the stock compared with the market portfolio. The figure below shows the event window timeline.

Figure 4.3.3.1 – Event study timeline



To determine the normal returns for a specific security the market model is used. The following formulas were retrieved from (McWilliams & Siegel, 1997).

"The rate of return on the share price of firm i on day t is expressed as:"

Equation 4.3.3.1 – Market model return, where R_{it} is expected rate of return of a particular security i on day t. α_i is the intercept term of the regression between the stock i and the returns of the market portfolio. β is the beta coefficient obtained from running the OLS regression between the returns of security i and the market portfolio. β is also known as the systematic risk of the stock. ε_{it} is the error term with $E(\varepsilon_{it}) = 0$

$$R_{it} = \alpha_i + \beta R_{mt} + \varepsilon_{it}$$

After estimating the normal return of stock i, the normal return is deducted from the actual return in order to determine the abnormal returns for each bank in the sample. The formula is as follows:

Equation 4.3.3.2 – Computing the abnormal returns

$$AR_{it} = R_{it} - (\alpha_i + b_i R_{mt}) \text{ or } \varepsilon_{it} = R_{it} - (\alpha_i + b_i R_{mt})$$

Since this study is interested in capturing the aggregated reaction to the Basel regulation, the cross-sectional abnormal returns from the vent window are averaged to obtain the abnormal average returns (AAR).

Equation 4.3.3.3 – Average Abnormal Returns

$$AAR_t = \sum_{t=T1}^{T2} AR_{it}$$

To determine the significance of the results a crude dependent adjustment test was used as in (Brown & Warner, 1980). To determine whether the AAR across firms in a particular day are statistically different from zero que following parametric significance test in equation 4.3.3.6 is used. The variance for the average abnormal returns is computed by taking the variance of the average of the abnormal returns along the estimation window. It's important to note that since this is a parametric test, we need to assume that the distributions of abnormal returns are normally distributed.

Equation 4.3.3.4 – Average abnormal returns in the estimation window

$$AAR_t = \sum_{t=T0}^{T1} AR_{it}$$

Equation 4.3.3.5 – Variance of the average abnormal returns in the estimation window

$$S_{AAR}^2 = \frac{1}{M-2} \sum_{t=T0}^{T1} \left(AAR_t - \overline{AAR}\right)^2$$

Where $\overline{AAR}$ is:

Equation 4.3.3.6 – Average of the average abnormal returns in the estimation window

$$\overline{AAR} = \frac{\sum_{t=T0}^{T1} AAR_t}{M}$$

Equation 4.3.3.6 - To test whether AAR is significantly different from zero:

$$H_0: AAR = 0$$

$$t_{AAR_t} = \frac{AAR_t}{S_{AAR}}$$

To estimate the abnormal returns around an event window larger than [0], the cumulative abnormal returns (CAR) are computed. This allows for a larger window to test the effects of the announcement before and after the event date. In this study, the CARs were calculated for each event window for every firm. The CAR formula is included below from (McWilliams & Siegel, 1997).

Equation 4.3.3.7 – Computing the CARs for all i firms

$$CAR_i(t1, t2) = \sum_{t=t1}^{t2} AR_{it}$$

Equation 4.3.3.8 - Similar to the AAR, the cumulative average abnormal returns (CAAR) are computed.

$$CAAR = \frac{1}{N}\sum_{i=1}^{N} CAR_i$$

To determine whether the CAAR are significantly different from zero the following t-test is done. Just like the test for the significance of AAR, this test also assumes that each bank's abnormal returns are normally distributed.

Equation 4.3.3.9 – Significance test for the CAAR

$$H_0: CAAR = 0$$

$$t_{CAAR} = \frac{CAAR}{\sqrt{T2 - T1}S_{AAR}}$$

4.3.4 - Event study results

From here onwards, the business models will be labelled as follows:

Model Label	Type of Structure
Model 1 (T/T)	Traditional assets / Traditional liabilities
Model 2 (NT/T)	Non-Traditional assets / Traditional liabilities
Model 3 (T/NT)	Traditional assets / Non-Traditional liabilities
Model 4 (NT/NT)	Non-traditional assets / Non-traditional liabilities

4.3.4.1 – Event 1: 30 of March of 2009

On the 30th of March of 2009 the average abnormal returns (AAR) for all banks in the sample was negative, being -1.11%. Model 2 (NT/T) ,3 (T/NT) and 4 (NT/NT) banks had larger negative AAR than model 1 (T/T) banks which had a negative AAR of -0.51%. This result is in line with the expectation that more traditional banks would be affected the least by Basel III as predicted in the report by (McKinsey&Company, 2010). The announcement from the 30th of March 2009 reported that a big focus of Basel III will be devoted to derivative and securitization businesses, and on the liquidity sources of banks so the results make sense from this perspective. However, most of the results obtained were not statistically significant. Only the result for window [0] on Model 3 (T/NT) is statistically significant with a 0.10 significance level, therefore it is not possible to make any statistical inferences for the remaining models. On the event date, the AAR for Model 3 was negative by -1.62%. The market did not have sufficient information yet to quantify the specific impacts Basel III would bring. This could be an explanation why the impacts were not more significant.

The cumulative abnormal returns (CAAR) on the larger event windows [-3,+3] and [-1,+1] were not statistically significant, so no inferences can be made.

The histograms on window [0] and [-1,+1] show that the abnormal returns have a tendency towards zero. The histogram on window [-3,+3] shows positive skewness as there are some outliers on the right side of the histogram.

Table 4.3.4.1.1 : Represents AAR and CAAR on the 30 of March of 2009. In parenthesis is the t test. The asterisk represents the level of confidence. * denotes significance level of 0.10, ** significance level of 0.05 and * significance level of 0.01.**

30/03/2009

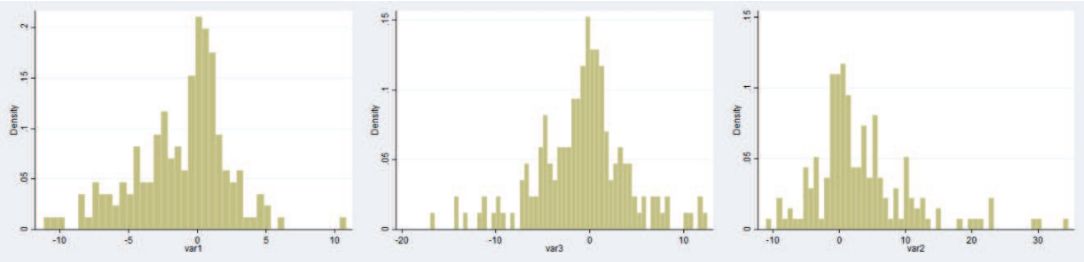
AAR	Total	Model 1 (T/T)	Model 2 (NT/T)	Model 3 (T/NT)	Model 4 (NT/NT)
Day Count	171	83	27	58	3
-3	0,90195 (1,06455)	0,44986 (0,49079)	1,86441 (1,85226)*	1,07431 (1,22622)	1,41537 (0,89301)
-2	1,79889 (2,12320)**	1,26873 (1,38417)	2,00211 (1,98907)*	2,25586 (2,57483)***	5,80299 (3,66133)*
-1	0,24980 (0,29483)	0,11994 (0,13085)	-0,27373 (-0,27194)	0,57656 (0,65809)	2,23687 (1,41133)
0	**-1,11276 (-1,31337)**	**-0,51265 (-0,55929)**	**-1,66216 (-1,65134)**	**-1,61502 (-1,84339)***	**-3,06089 (-1,93123)**
1	0,09175 (0,10829)	-0,19564 (-0,21344)	1,11696 (1,10969)	-0,06813 (-0,07777)	1,90742 (1,20346)
2	0,11852 (0,13989)	0,30035 (0,32768)	-0,13455 (-0,13367)	-0,13490 (-0,15398)	2,26550 (1,42939)
3	1,24277 (1,46682)	1,52821 (1,66726)*	0,21202 (0,21064)	1,29230 (1,47503)	1,66483 (1,05041)
CAAR	Total	Model 1 (T/T)	Model 2 (NT/T)	Model 3 (T/NT)	Model 4 (NT/NT)
[-3,+3]	3,29094 (1,46810)	2,95882 (1,22008)	3,12506 (1,17347)	3,38096 (1,45857)	12,2321 (2,91701)
[-1,+1]	-0,77120 (-0,52552)	-0,58834 (-0,37058)	-0,81893 (-0,46973)	-1,10660 (-0,72923)	1,08339 (0,39465)

Graph 4.3.4.1.1 – Histogram AR and CARs 30 Mar 2009

AR 30 March 2009

CAR[-1,+1] 30 March 2009

CAR [-3,+3] 30 March 2009



4.3.4.2 – Event 2: 17 of December 2009

On the 17th of December of 2009, the AAR of the sample of banks was very close to zero, -0.08%. The results on the event date are not significantly different from zero as an aggregate or for any business model. The AAR results suggest that the announcement did not cause a reaction in the market. This could be because the measures were already expected, or the announcement did not present anything new.

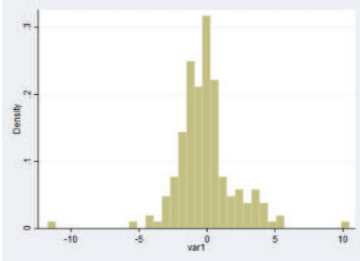
On the larger event window [-3,+3], the CAAR for the aggregate of banks was -3.25%, statistically significant with a 0.10 significance level. Model 1 (T/T) CAAR result was -3.95% also statistically significant with a 0.10 significance level. The remaining models also had negative AARs but the results were not statistically significant, so no inferences can be made. The statistically significant results in the [-3,+3] event window for the aggregate and for Model 1 (T/T) banks were negative, which suggests that the market expects lower future returns for the aggregate of banks in the sample and in particular for Model 1 (T/T) banks. This event was marked by the first two comprehensive documents that were to become the Basel III framework. Just like in the previous announcement, it was expected for the AR of banks to drop, which this event study confirms. It was also expected for the less traditional models to have a bigger decrease in abnormal returns after this announcement but none of the results for non-traditional models were statistically significant, so no conclusion can be made in this regard. All histograms show a tendency to zero.

Table 4.3.4.2.1 Represents AAR and CAAR on the 17th of December of 2009. In parenthesis is the t test. The asterisk represents the level of confidence. * denotes significance level of 0.1, ** significance level of 0.05 and * significance level of 0.01.**

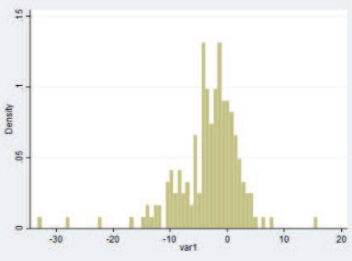
17 December 2009

AAR	Total	Model 1 (T/T)	Model 2 (NT/T)	Model 3 (T/NT)	Model 4 (NT/NT)
Day Count	173	84	28	58	3
-3	-0,73449 (-1,03728)	-0,87388 (-1,10616)	-0,76010 (-0,96069)	-0,51531 (-0,67485)	-1,07516 (-0,63440)
-2	-0,27102 (-0,38275)	-0,42818 (-0,54199)	-0,32445 (-0,41008)	0,014332 (0,018770)	-0,97942 (-0,57791)
-1	-0,76664 (-1,08268)	-1,00382 (-1,27065)	-0,13993 (-0,17686)	-0,69315 (-0,90775)	-1,65083 (-0,97408)
0	**-0,07973 (-0,11259)**	**-0,27678 (-0,35035)**	**0,335736 (0,424338)**	**-0,00105 (-0,00137)**	**0,012316 (0,007267)**
1	0,010102 (0,014266)	-0,02423 (-0,03067)	0,274528 (0,346977)	-0,04903 (-0,06421)	-0,34985 (-0,20643)
2	-0,39626 (-0,55962)	-0,26621 (-0,33697)	-0,12133 (-0,15335)	-0,81631 (-1,06904)	1,385022 (0,817236)
3	-1,01249 (-1,42989)	-1,08566 (-1,37423)	-0,92584 (-1,17017)	-0,96969 (-1,26990)	-0,93778 (-0,55334)
CAAR	Total	Model 1 (T/T)	Model 2 (NT/T)	Model 3 (T/NT)	Model 4 (NT/NT)
[-3,+3]	-3,25056 (-1,73507)*	-3,95878 (-1,89399)*	-1,66140 (-0,79367)	-3,03024 (-1,49990)	-3,59573 (-0,80191)
[-1,+1]	-0,83626 (-0,68185)	-1,30484 (-0,95359)	0,470331 (0,343208)	-0,74324 (-0,56195)	-1,98837 (-0,67737)

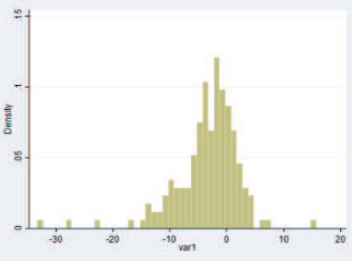
AR 17 Dec 2009



CAR[-1,+1] 17 Dec 2009



CAR [-3,+3] 17 Dec 2009



4.3.4.3 – Event 3: 16 of July 2010

On the 16th of July of 2010, the AAR of the sample was of 0.86%, statistically significant with a significance level of 0.10. Model 1 (T/T) banks had AAR on event date of 1.07% with a significance level of 0.05. The market reaction was positive, which was an unexpected result prior to the study taking into consideration that the countercyclical capital buffer was introduced. Possibly the market assessed that this new additional capital buffer could be positive for banking activity and considered the announcement a sign that the new Basel framework was going in the right direction. Model 2 (NT/T), 3 (T/NT) and 4 (NT/NT) did not have statistically significant AAR on the event date, so no inferences can be made regarding these models.

The CAAR results show the same trend. The CAAR on event window [-1,+1] for the aggregate of all banks was 2.23% with a significance level of 0.10. Model 1 (T/T) CAAR [-1,+1] was 2.39% with a significance level of 0.05. Model 2 (NT/T) CAAR on window [-1,+1] was 2.03% with a significance level of 0.10. Model 3 (T/NT) CAAR on window [-1,+1] was 1.73% with a 0.10 significance level.

Model 1 (T/T) and Model 2 (NT/T) had slightly larger abnormal returns than Model 3 (T/NT). Model 1 (T/T) and 2 (NT/T) have a traditional liability structure, so the market could be rewarding this characteristic.

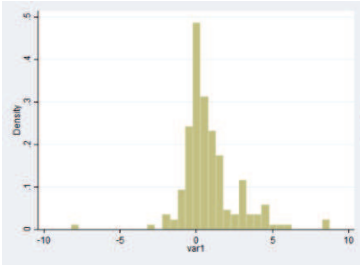
All three histograms show a slight skewness to the right.

Table 4.3.4.3.1: Represents AAR and CAAR on the 16th of July of 2010. In parenthesis is the t test. The asterisk represents the level of confidence. * denotes significance level of 0.10, ** significance level of 0.05 and * significance of 0.01.**

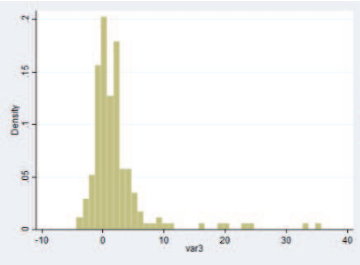
16 July 2010

AAR	Total	Model 1 (T/T)	Model 2 (NT/T)	Model 3 (T/NT)	Model 4 (NT/NT)
Day Count	173	103	28	39	3
-3	-0,36377 (-0,75474)	-0,39210 (-0,73769)	-0,61055 (-0,99715)	0,040252 (0,071800)	-2,33987 (-1,47132)
-2	-0,06685 (-0,13871)	-0,05786 (-0,10885)	-0,07775 (-0,12698)	-0,11847 (-0,21133)	0,397009 (0,249641)
-1	0,968862 (2,010177)**	1,087120 (2,045256)**	1,267725 (2,070424)**	0,505126 (0,901019)	0,147859 (0,092974)
0	**0,864915 (1,794508)***	**1,074280 (2,021100)****	**0,247539 (0,404276)**	**0,687683 (1,226655)**	**1,742875 (1,095928)**
1	0,399712 (0,829316)	0,230248 (0,433178)	0,516204 (0,843055)	0,539336 (0,962041)	3,315624 (2,084880)
2	-0,53435 (-1,10867)	-0,43185 (-0,81247)	-0,81760 (-1,33530)	-0,52362 (-0,93402)	-1,54929 (-0,97420)
3	-0,25203 (-0,52292)	-0,33732 (-0,63462)	0,045692 (0,074623)	-0,59811 (-1,06688)	4,396173 2,764335)
CAAR	Total	Model 1 (T/T)	Model 2 (NT/T)	Model 3 (T/NT)	Model 4 (NT/NT)
[-3,+3]	1,016465 (0,797105)	1,172501 (0,833747)	0,571244 (0,352620)	0,532179 (0,358792)	6,110377 (1,452228)
[-1,+1]	2,233490 (2,675442)***	2,391649 (2,597807)**	2,031469 (1,915507)*	1,732147 (1,783848)*	5,206358 (1,890119)

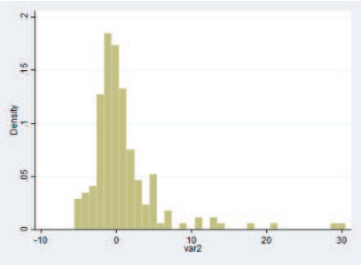
AR 16 Jul 2010



CAR[-1,+1] 16 Jul 2010



CAR [-3,+3] 16 Jul 2010



4.3.4.4 – Event 4: 26 of July 2010

On the 26th of July of 2010 the average abnormal returns were not significantly different from zero on the date of the event, but they were very significant on the day following the event. The BCBS does not mention at what time they posted the press release, but the results suggest that the press release happened past market hours. On the day of the event only Model 2 (NT/T) had a statistically significant AAR of 1.14% with significance level of 0.10. On the day following the event, the AAR for the sample of banks was positive at 1.73% with a significance level of 0.01. Model 1 (T/T), Model 2 (NT/T) and Model 3 (T/NT) had statistically significant AAR of 1.40%, 2.35% and 2.31% respectively and with significance levels of 0.05, 0.01, and 0.01 respectively. Model 2 (NT/T) and 3 (T/NT) had higher abnormal returns than Model 1 (T/T). A big focus of this announcement was on the agreement and definition of the liquidity reform package. The market could be rewarding better liquidity requirements, which goes in line with the suggestion by (Bordeleau & Graham, 2010) that less traditional banks benefit more by holding more liquid assets. The market could be rewarding the higher liquidity that these banks will have to hold. This conclusion goes against (Mergaerts & Vennet, 2016) and (Molyneux & Thornton, 1992), which obtained the opposite result.

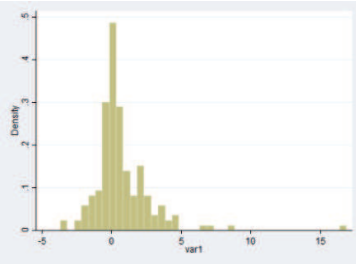
The CAAR on window [-1,+1] of 1.95% for the entire sample of banks is statistically significant with a significance level of 0.05. Model 2 (NT/T) and Model 3 (T/NT) also had statistically significant CAARs of 3.14% and 2.10% respectively with significance levels of 0.01 and 0.05 respectively.

The histograms show that there is a tendency for the abnormal returns to be above zero as they are skewed to the right.

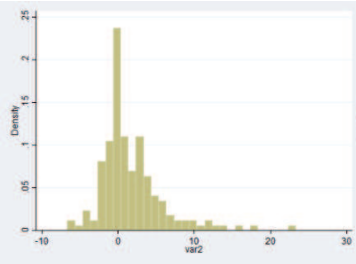
Table 4.3.4.4.1: Represents AAR and CAAR on the 26th of July of 2010. In parenthesis is the t test. The asterisks is the level of confidence. * denotes significance level of 0.10, ** significance level of 0.05 and * significance level of 0.01.**

	26 July 2010				
AAR	Total	Model 1 (T/T)	Model 2 (NT/T)	Model 3 (T/NT)	Model 4 (NT/NT)
Day Count	173	103	28	39	3
-3	-0,25303 (-0,51929)	-0,33520 (-0,62725)	0,040727 (0,065918)	-0,60417 (-1,07298)	4,390903 (2,717381)
-2	-0,26485 (-0,54353)	-0,20143 (-0,37695)	-1,00462 (-1,62600)	0,184639 (0,327911)	-1,38075 (-0,85450)
-1	-0,65841 (-1,35122)	-0,68581 (-1,28336)	-0,34850 (-0,56405)	-0,92196 (-1,63737)	0,815914 (0,504942)
0	**0,743435 (1,525704)**	**0,694861 (1,300284)**	**1,139408 (1,844147)***	**0,715510 (1,270712)**	**-0,92155 (-0,57031)**
1	1,729031 (3,548378)***	1,400938 (2,621558)**	2,351404 (3,805779)***	2,306725 (4,096637)***	-0,32530 (-0,20132)
2	0,080758 (0,165736)	0,122023 (0,228340)	0,095053 (0,153845)	0,043354 (0,076995)	-0,98313 (-0,60843)
3	0,570295 (1,170379)	0,579049 (1,083567)	0,326911 (0,529109)	0,768112 (1,364132)	-0,03029 (-0,01875)
CAAR	Total	Model 1 (T/T)	Model 2 (NT/T)	Model 3 (T/NT)	Model 4 (NT/NT)
[-3,+3]	1,947214 (1,510399)	1,574413 (1,113551)	2,600372 (1,590752)	2,492200 (1,672882)	1,565766 (0,366247)
[-1,+1]	1,814048 (2,149390)**	1,409980 (1,523326)	3,142309 (2,936327)***	2,100268 (2,153504)**	-0,43094 (-0,15397)

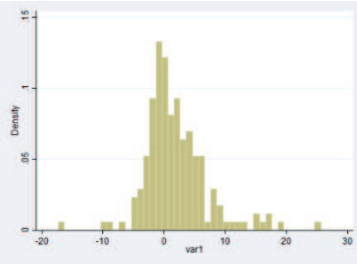
AR 26 Jul 2010



CAR[-1,+1] 26 Jul 2010



CAR [-3,+3] 26 Jul 2010



4.3.4.5 – Event 5: 12 of September 2010

On the 12th of September of 2010, the AAR for the entire sample of banks was 0.51%. However, this result is not statistically significant. The AARs and the CAARs on and around this date were not significantly different from zero, which tells us that the press release of the 12th of September either did not provide new information to the market or the new measures will not significantly impact the banks in the sample. The exception was on Model 3 (T/NT) which had a positive statistically significant AAR on the event date of 1.24% with significance level of 0.05.

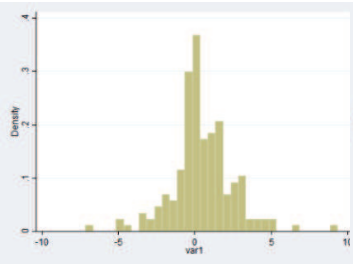
On the 12th of September 2010 the BCBS increased the capital requirements and introduced a new capital buffer, the capital conservation buffer. One possible explanation for the Model 3 (T/NT) result is that the market could be rewarding the more stringent capital requirements because it believes that it will not hurt the long-term returns of Model 3 (T/NT) banks but will actually improve it. The announcement also provided phase-in projections. The market could also be rewarding the fact that the implementation will be phased-in and will not take full effect immediately which would require banks to accelerate their compliance efforts which would be costlier.

Table x: Represents AAR and CAAR on the 12th of September of 2010. In parenthesis is the t test. The asterisks is the level of confidence. * denotes significance level of 0.10, ** significance level of 0.05 and *** significance level of 0.01.

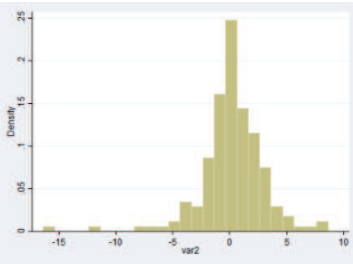
12 September 2010

AAR	Total	Model 1 (T/T)	Model 2 (NT/T)	Model 3 (T/NT)	Model 4 (NT/NT)
Day Count	173	103	28	39	3
-3	-0,42641 (-0,94082)	-0,14527 (-0,29763)	-1,09648 (-1,85101)*	-0,70180 (-1,27129)	-0,38704 (-0,23988)
-2	0,148372 (0,327360)	0,120898 (0,247686)	0,301236 (0,508524)	0,227867 (0,412773)	-1,31904 (-0,81753)
-1	-0,10428 (-0,23009)	-0,20296 (-0,41582)	0,086916 (0,146726)	-0,02653 (-0,04806)	0,453669 (0,281181)
0	**0,515212 (1,136732)**	**0,252835 (0,517987)**	**0,532168 (0,898368)**	**1,242269 (2,250321)****	**0,085237 (0,052829)**
1	-0,19700 (-0,43465)	-0,29564 (-0,60569)	0,242107 (0,408709)	-0,30190 (-0,54689)	0,389462 (0,241387)
2	-0,02702 (-0,05962)	-0,02543 (-0,05210)	-0,02335 (-0,03943)	0,003815 (0,006910)	-0,52563 (-0,32578)
3	0,211621 (0,466907)	0,119077 (0,243955)	0,254571 (0,429749)	0,459583 (0,832517)	-0,16486 (-0,10218)
CAAR	Total	Model 1 (T/T)	Model 2 (NT/T)	Model 3 (T/NT)	Model 4 (NT/NT)
[-3,+3]	0,120476 (0,100467)	-0,17651 (-0,13668)	0,297151 (0,189598)	0,903288 (0,618452)	-1,46821 (-0,34394)
[-1,+1]	0,213923 (0,272502)	-0,24577 (-0,29071)	0,861193 (0,839353)	0,913828 (0,955724)	0,928369 (0,332206)

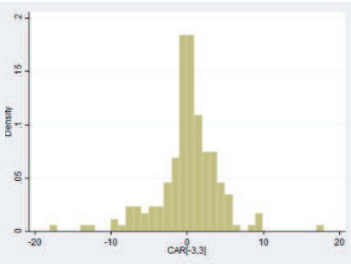
AR 12 Sep 2010



CAR[-1,+1] 12 Sep 2010



CAR [-3,+3] 12 Sep 2010



4.3.4.6 – Event 6: 16 of December 2010

On the 16th of December of 2010 the full draft of the Basel III document was published. The AAR for the entire sample of banks was close to zero and not statistically different from zero. Individually, Model 1 (T/T), 2 (NT/T) and 3 (T/NT) have values close to zero and the results are not significantly different from zero. These results show that market participants either already knew what the conditions of Basel III were going to be, so the release of the final document was not material.

The CAAR on the larger window [-3,+3] for the aggregate of banks has a statistical significant result of -1.96% with a significance level of 0.10. Model 2 (NT/T) CAAR on window [-3,+3] was -3.39% and this result is also statistically significant with a significance level of 0.05. On the larger event window, the market predicted lower future returns for the aggregate of banks in the sample and specifically for Model 2 (NT/T) banks. Taking these results in consideration, the market could be assessing that the full Basel III reform as introduced in 16th of December 2010 will negatively impact the banks in the sample and in particular Model 2 (NT/T) banks.

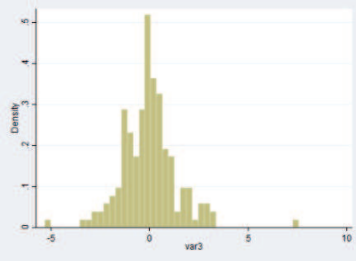
The histograms show a tendency towards zero with a few outliers on the left side of the histogram on window [-3,+3] and [-1,+1].

Table 4.3.4.6.1: Represents AAR and CAAR on the 16th of December of 2010. In parenthesis is the t test. The asterisks is the level of confidence. * denotes significance level of 0.10, ** significance level of 0.05 and *** significance level of 0.01.

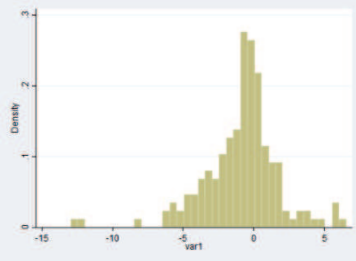
16 Dec 2010

AAR	Total	Model 1 (T/T)	Model 2 (NT/T)	Model 3 (T/NT)	Model 4 (NT/NT)
Day Count	173	103	28	39	3
-3	-0,30917 (-0,73837)	-0,39655 (-0,91535)	-0,11428 (-0,19935)	-0,22302 (-0,41101)	-0,35131 (-0,22319)
-2	-0,10099 (-0,24120)	0,036008 (0,083117)	-0,19067 (-0,33259)	-0,23215 (-0,42783)	-2,29659 (-1,45908)
-1	-0,11406 (-0,27239)	-0,21748 (-0,50202)	-0,21166 (-0,36921)	0,157906 (0,291001)	0,774252 (0,491901)
0	**0,002776** **(0,006631)**	**0,117817** **(0,271954)**	**-0,12849** **(-0,22413)**	**-0,10939** **(-0,20159)**	**-1,26263** **(-0,80218)**
1	-0,73088 (-1,74547)*	-0,56593 (-1,30633)	-1,26735 (-2,21070)**	-0,83268 (-1,53453)	-0,30717 (-0,19515)
2	0,008251 (0,019705)	0,060131 (0,138799)	-0,49110 (-0,85664)	0,252032 (0,464465)	-0,27876 (-0,17710)
3	-0,71651 (-1,71116)*	-0,72382 (-1,67078)*	-0,98761 (-1,72272)*	-0,40749 (-0,75097)	-2,19143 (-1,39227)
CAAR	Total	Model 1 (T/T)	Model 2 (NT/T)	Model 3 (T/NT)	Model 4 (NT/NT)
[-3,+3]	-1,96060 (-1,76973)*	-1,68984 (-1,47429)	-3,39119 (-2,23580)**	-1,39482 (-0,97155)	-5,91366 (-1,42004)
[-1,+1]	-0,84216 (-1,16119)	-0,66560 (-0,88704)	-1,60752 (-1,61892)	-0,78416 (-0,83434)	-0,79555 (-0,29181)

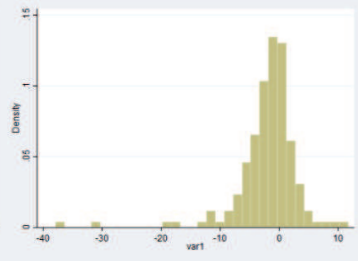
AR 16 Dec 2010



CAR[-1,+1] 16 Dec 2010



CAR [-3,+3] 16 Dec 2010



4.4 - Regression analysis methodology and results

In this thesis, an OLS regression analysis is used to understand if the effects captured by the ARs and the CARs could be explained by the business model categorization method used. Various independent variables are also added to the analysis to determine if the AR and the CARs could also be explained by other factors and make the regression model more robust. The additional variables used are market capitalization, return on assets, return on equity and equity over total assets.

4.4.1 – OLS Regression independent variables

Market capitalization

The market capitalization is used as an independent variable to determine if size plays a role in the abnormal returns results obtained. It could be argued that larger banks can benefit from economies of scale when working towards Basel III compliance and therefore have a size advantage. The opposite can also be argued, as larger banks could be at a disadvantage because they can be classified as systemically important banks and required to hold larger capital buffers.

Returns on assets and equity

These independent variables are related to profitability. It is reasonable to assume that more profitable banks can more easily build up the capital needed to fulfill the Basel III requirements and as a consequence the abnormal returns be less impacted by the announcements in comparison with banks with lower profitability.

Equity over total assets

This is a bank capital metric. Banks that have more equity and less liabilities are less leveraged and therefore Basel III can have a smaller impact on these banks as the liquidity and capital requirements won't be as cumbersome.

4.4.2 - Univariate analysis

In this thesis, a univariate regression analysis is conducted with all the above independent variables to understand which variables best explain the AR and CAR results obtained. The results show the R-Squared results were quite low for all variables, so the explanatory power of these regressions is low. It can be concluded from these results that these variables cannot be taken in isolation when explaining ARs and CARs.

Univariate regression analysis table

Univariate Analysis

	Event 1 - 30/03/2009			Event 2 - 17/12/2009			Event 3 - 16/07/2010		
	AR [0]	CAR [-3,+3]	CAR [-1,+1]	AR [0]	CAR [-3,+3]	CAR [-1,+1]	AR [0]	CAR [-3,+3]	CAR [-1,+1]
Mkt Cap	-0,0580***	0,01655	-0,0445**	0,00037	-0,0439*	-0,0125	-0,0169**	-0,0202	-0,0255
	(3,17866)	(7,37179)	(4,66365)	(2,01897)	(5,34417)	(2,95420)	(1,71265)	(5,02366)	(5,40666)
R Sq.	0,08410	0,00138	0,02448	0,00000	0,01831	0,00491	0,02371	0,00398	0,00547
Ret Assets	-0,0056	-0,7233	0,02351	0,05002	0,70882*	0,13905	-0,2116**	0,27442	-0,3432
	(3,32139)	(7,33206)	(4,72173)	(2,01820)	(5,33474)	(2,95738)	(1,70672)	(5,01840)	(5,39928)
R Sq.	0,00000	0,01212	0,00003	0,00077	0,02177	0,00277	0,03045	0,00606	0,00818
Ret Equity	0,02007	-0,0660	0,00534	-0,0032	0,07312**	0,02212	-0,0416***	-0,0279	-0,0771***
	(3,31367)	(7,33924)	(4,72142)	(2,01864)	(5,33035)	(2,95096)	(1,60421)	(5,01430)	(5,28339)
R Sq.	0,00464	0,01018	0,00016	0,00033	0,02338	0,00709	0,14342	0,00769	0,05030
E/A	0,17191	2,51981	6,94180	-0,1411	16,6777***	0,23249	-1,4048	1,48215	-3,5878
	(3,32138)	(7,37467)	(4,69517)	(2,01895)	(5,25785)	(2,96145)	(1,73101)	(5,03281)	(5,41669)
R Sq.	0,00001	0,00060	0,01125	0,00002	0,04976	0,00003	0,00267	0,00035	0,00178

Standard error in parenthesis. * p<0.10; ** p<0.05; *** p< 0.01

Univariate

	Event 4 - 26/07/2010			Event 5 - 12/09/2010			Event 6 - 16/12/2010		
	AR [0]	CAR [-3,+3]	CAR [-1,+1]	AR [0]	CAR [-3,+3]	CAR [-1,+1]	AR [0]	CAR [-3,+3]	CAR [-1,+1]
Mkt Cap	0,01510	0,04671*	0,04529**	0,01688*	0,02118	0,02698*	-0,0171**	-0,0472**	-0,0219*
	(2,11172)	(5,22459)	(4,10093)	(2,00935)	(4,08112)	(2,85447)	(1,43043)	(4,06379)	(2,39741)
R Sq.	0,01249	0,01939	0,02929	0,01716	0,00662	0,02162	0,03436	0,03236	0,02038
Ret Assets	-0,1554	-0,0539	-0,4448*	0,01747	0,24434	0,26849*	-0,1879**	0,18675	0,00957
	(2,11339)	(5,27543)	(4,11351)	(2,02667)	(4,07978)	(2,86022)	(1,43066)	(4,12256)	(2,42219)
R Sq.	0,01093	0,00021	0,02332	0,00015	0,00727	0,01767	0,03405	0,00417	0,00003
Ret Equity	-0,0227**	-0,0228	-0,0410**	0,00644	0,05475***	0,03038**	-0,0292***	0,05760***	0,00283
	(2,09448)	(5,26368)	(4,11167)	(2,02427)	(4,00264)	(2,84579)	(1,38086)	(4,03011)	(2,42182)
R Sq.	0,02855	0,00466	0,02419	0,00251	0,04445	0,02757	0,10012	0,04833	0,00034
Eq/ Asse	-5,1482**	-12,675**	-13,627***	-8,3742***	0,00306	-2,1126	1,15914	8,09864	1,73270
	(2,09953)	(5,21373)	(4,07065)	(1,95523)	(4,09470)	(2,88270)	(1,45378)	(4,09880)	(2,41971)
R Sq.	0,02386	0,02346	0,04357	0,06939	0,00000	0,00217	0,00257	0,01562	0,00208

Standard error in parenthesis. * p<0.10; ** p<0.05; *** p< 0.01

Market Cap

Regarding market capitalization, there are statistically significant results for every event. For announcements 1, 2, 3, and 6, the models predict an inverse relationship between market capitalization and abnormal returns, as the market capitalization increases the ARs and CARs decrease. For event dates 4 and 5 the inverse is true, as market capitalization increases, the ARs and CARs increase. This suggests that the impact of market capitalization is not straightforward as larger banks can have an advantage in some events and be at a disadvantage in other events. One possible explanation could be that larger banks can benefit from economies of scale when applying compliance to Basel III but could be at a disadvantage if they are too big because they would be considered systemically important and therefore be subject to stricter capital requirements. The R-Squared values were low, the highest value was on Event 1, window [0] with a R-Squared value of 0.0841. It can be concluded form these results that the regressions have low explanatory power.

For the first announcement, the coefficient on the event date [0] predicts a decrease of abnormal returns of -0.058% per one billion increase in market capitalization. This result was statistically significant with a p-value lower than 0.01. At time window [-1,+1], the coefficient obtained was -0.0445% and the p-value is below 0.05. On event 2, the only statistically significant coefficient was on the [-3,+3] window with a coefficient of -0.044 with a p-value below 0.10. On event 3, the only event window with a statistically significant coefficient was AR[0] with -0.0169 with a p-value below 0.05. Event 4 on window [-3,+3] had a coefficient of 0.0467 with a p-value below 0.10 and event window [-1,+1] with a coefficient of 0.0453 and p-value below 0.05. Event 5 shows two statistically significant coefficients on window [0] and [-1,+1]. On window [0] the coefficient was 0.0169 with a p-value below 0.10 and window [-1,+1] coefficient was 0.0270 also with a p-value below 0.10. All coefficients in event 6 are statistically significant. On window [0] the coefficient of -0.0171 has a p-value below 0.05, event window [-1,+1] coefficient of -0.0219 has a p-value below 0.10 and window [-3,+3] coefficient of -0.0472 has a p-value below 0.05.

The statistically significant coefficients are small. This tells us that even if the results are statistically significant, market capitalization does not have a big influence on ARs and CARs as an increase in market capitalization will have a residual impact in abnormal returns.

ROA

For return on assets, the results turned out not statistically significant for most coefficients except in 5 cases. Some regression coefficients were different from the expected results. It would be expected for all statistically significant coefficients to be positive. The logic would be that banks should expect higher abnormal returns the more profitable they are. However, this did not turn up to be the case. Event 2 and 5 had statistically significant positive coefficients while event 3, 4 and 6 had statistically significant negative coefficients. One possible explanation could be that the more profitable banks have assets and liabilities in their balance sheet subjected to large capital requirements increases justifying the market reaction to the announcements.

Event 2 on window [-3,+3] has a coefficient of 0.709 with a p-value below 0.10. This can be interpreted as a 1% increase in ROA translates into an increase of 0.71% of abnormal returns. Event 5 has a statistically significant coefficient on window [-1,+1] of 0.268 with a p-value below 0.10. Event 3 on window [0] has a negative coefficient of -0.212 with a p-value below 0.05. Event 4 on window [-1,+1] has a statistically significant coefficient of -0.445 with a p-value below 0.01. Event 6 on window [0] has a statistically significant coefficient of -0.188 with a p-value below 0.10.

The R-Squared values were low, the highest value being 0.034. From this, it can be concluded that the regression does not have high explanatory power.

ROE

Regarding ROE, similarly to ROA, the coefficient of the regression did not return the values expected prior to the study. It was expected that all statistically significant coefficients would turn out to be positive as more profitable banks can more easily build up capital ratios. However, this prediction did not materialize in the results. The regressions returned very low coefficients, so even if the results would be statistically significant, 1% increase in ROE would not have a big effect on ARs and CARs. The statistically significant coefficients in events 2 and 5 are positive while the statistically significant coefficient in events 3 and 4 were negative. Event 6 has one negative statistically significant coefficient on window [0] and a positive statistically significant coefficient on window [-3,+3]. Similar to ROA, it could be argued that the more profitable banks could be the most affected negatively by Basel III requirements justifying the negative market reaction to the announcements.

Event 2 on window [-3,+3] has a statistically significant coefficient of 0.0731 with a p-value below 0.05. The interpretation of this result is that an increase of 1% in ROE translates into an increase of 0.0731% in abnormal returns. Event 3 has two statistically significant coefficients of -0.0416 and -0.0771 on window [0] and [-1,+1] respectively both a with p-value below 0.01. Event 4 has one statistically significant coefficient on window [-1,+1] of -0.041 with a p-value below 0.05. Event 5 has two statistically significant coefficients on window [-3,+3] and [-1,+1] of 0.0548 and 0.0304 respectively with a with p-value below 0.01 and 0.05 respectively. Event 6 also has two statistically significant coefficients on window [0] and [-3,+3] of -0.0292 and 0.0576 respectively both with a p-value below 0.01.

The R-Squared results also turned out to have low explanatory power for all event windows.

Equity/Assets

On the equity/assets regressions there were statistically significant results on events 2, 4 and 5. The majority of the statistically significant results were negative except on event 2 which was positive.

On event 2, the coefficient on window [-3,+3] is 0.167 with a p-value below 0.01. This result tells us that a 1% increase in equity over assets ratio, it is expected for the cumulative abnormal returns to increase by 0.167%. This value is the only positive coefficient obtained in all event windows. On event 4, all three coefficients obtained for all three event windows were highly statistically significant. On window [0], [-3,+3] and [-1,+1] the coefficients obtained were -0.051, -0.127, and -0.136 respectively. These coefficients are negative which tells us that an increase of 1% in equity over assets ratio would result in a decrease of cumulative abnormal returns by -0.051% for window [0], -0.1268% for window [-3,+3], and -0.1363% for window [-1,+1]. On event 5, only window [0] had a statistically significant result with a coefficient of -0.837 with a p-value below 0.01.

4.4.3 – Multiple regression analysis

This section includes two multiple OLS regression analysis. First, ARs and CARs were regressed on business models as dummy variables. Second, to get a more robust model, an OLS regression was computed with all independent variables previously discussed and also including business models as dummy variables.

4.4.3.1 – Regression with business models and results

In this section the regression of ARs and CARs with business models as dummy variables is computed. The regression equation is stated as follows:

Equation 4.4.3.1 – OLS regression of ARs and CARs with business models as dummy variables

$$AR_{it}/CAR_{it} = \alpha + \beta_1 Model\,2 + \beta_2 Model\,3 + \beta_3 Model\,4$$

The intercept captures the expected ARs and CARs for Model 1 (T/T) banks. The R-Squared results obtained were low. The highest R-Squared results was 0.0509 on event 1 on window [0]. It can be inferred that the regression model has low explanatory power.

Event 1 – 30 March 2009

Analyzing table 4.4.3.1, there are two statistically significant coefficients in event 1 on window [0]: Model 2 (NT/T) and Model 3 (T/NT). Model 2 (NT/T) has a negative coefficient of -1.29 with a p-value below 0.10. Model 3 (T/NT) coefficient is -1.46 with a p-value below 0.05. It can be inferred from the data that Model 2 (NT/T) banks are expected to have AR -1.29% lower than Model 1 (T/T) banks. Similarly, Model 3 (T/NT) banks are expected to have AR -1.46% lower than Model 1 (T/T) banks. This result is in line with the results obtained in the event study section which suggest a decrease in the value of Model 3 (T/NT) banks. The results on window [0] go in line with the expectations prior to the study, which were that less-traditional models would have lower ARs as a result of this announcement.

On window [-3,+3], the intercept term is 2.95 and statistically significant with a p-value below 0.01. Model 4 (NT/NT) coefficient is 9.28 and statistically significant with a p-value below 0.05. This can be interpreted as Model 4 (NT/NT) banks being expected to have cumulative abnormal returns 9.28% above Model 1 (T/T) banks. The intercept term captures Model 1 (T/T) banks, so they are expected to have an AR of 2.95%.

The intercept term on the larger window [-3,+3] is statistically significant and positive. Model 4 (NT/NT) coefficients is also positive and large. No more coefficients were statisti-

cally significant in the window [-3,+3]. Window [-1,+1] did not have any statistically significant coefficients.

Event 2 – 17th of December 2009

On event 2, only window [-1,+1] and [-3,+3] have statistically significant coefficients. On event window [-3,+3] the intercept term is -3.63 and has a p-value below 0.01. This can be interpreted as Model 1 (T/T) banks are expected to have a CAR of -3.63%.

On window [-1,+1], the intercept term is -1.072 with a p-value below 0.01 and Model 2 (NT/T) has a coefficient of 1.427 with a p-value below 0.05. The remaining coefficients are not statistically different from 0. Interpreting the results, Model 1 (T/T) banks are expected to have -1.072% CAR and Model 2 (NT/T) banks are expected to have 1.427% higher CAR than Model 1 (T/T) banks.

The results suggest that the market is penalizing Model 1 (T/T) Banks more than Model 2 (NT/T) banks. The announcement of 17th of December 2009 was very comprehensive as it released the first two major documents of what was to become Basel III. The documents described the LCR and NSFR and increased capital requirements for exposures arising from derivatives and repo transactions. However, window [-1,+1] results suggest that the less traditional Model 2 (NT/T) are expected to have higher CARs than Model 1 (T/T) banks. These results could indicate that the market expected the Basel III framework to hurt traditional banks more than non-traditional banks or that regulation on non-traditional areas of banking was not as strict as expected prior to the announcement. Another possibility is that the market assumes that non-traditional banks can circumvent this regulation by engaging in regulatory arbitrage as suggested by (Balthazar, 2006) (Ayadi, et al., 2012).

Event 3 – 16 of July 2010

On event 3, the intercept term is statistically significant and positive for all event windows. The intercept terms are 1.089, 1.243, and 2.467 for windows [0], [-3,+3] and [-1,+1] respectively. The regression model predicts the CARs for Model 1 (T/T) banks in the sample to be positive and relatively large (above 1%). On window [-3,+3], Model 4 (NT/NT) has a statistically significant coefficient of 4.867. This can be interpreted as Model 4 (NT/NT) banks are expected to have CAR 4.867% above Model 1 (T/T) banks. The remaining coefficients were not significant on this event.

On this announcement, the BCBS announced the countercyclical capital buffer. The market could be perceiving this new ratio as positive for the long-term profitability of the banking sector. This could explain the positive and statistically significant AR results in Model 1 (T/T) banks.

Event 4 – 26th of July 2010

On Event 4, all the intercept terms are highly statistically significant, all having a p-value below 0.01. The intercept terms were 0.670, 1.50, and 1.312 for windows [0], [-3,+3] and [-1,+1] respectively. This can be interpreted as the regression model predicts the CARs for Model 1 (T/T) banks in the sample to be positive. Model 2 (NT/T) banks also have a statistically significant coefficient at the [-1,+1] event window of 2.330 with a p-value below 0.05. This tells us that Model 2 (NT/T) banks are expected to have 2.33% higher CAR than Model 1 (T/T) banks.

On event 4, as previously noted in the event study section, a big focus of this announcement was on the definition and agreement of the liquidity reform package, so the market could be rewarding better liquidity requirements. On window [-1,+1] Model 2 (NT/T) banks seem to be the most reward banks by the market after this announcement. On this announcement, a liquidity reform package was agreed, so the market could be perceiving that Model 2 (NT/T) banks would benefit the most by the introduction of liquidity requirements as defined in announcement 4.

Event 5 – 12th of September 2010

Event 5 only had 2 statistically significant coefficients. Model 3 (T/NT) on window [0] has a coefficient of 1.076 with a p-value below 0.01 and Model 3 (T/NT) on window [-1,+1] has a coefficient of 1.201 with a p-value below 0.05. So Model 3 (T/NT) banks are expected to have higher CAR than Model 1 (T/T) banks on event windows [0] and [-1,+1].

The conclusion of this result is similar to the one on the event study section. As noted in the event study section: "*On the 12th of September 2010 the BCBS increased the capital requirements and introduced a new capital buffer, the capital conservation buffer. One possible explanation for the Model 3 (T/NT) results is that the market could be rewarding the more stringent capital requirements because it believes that it will not hurt the long-term profitability of Model 3 (T/NT) banks but will actually improve it. The announcement also provided phase-in projections. The market could also be rewarding the fact that the imple-*

mentation will be phased-in and will not take full effect immediately which would require banks to accelerate their compliance efforts."

Event 6 – 16th of December 2010

On Event 6, the intercept term of -0.539 on event window [-1,+1] is statistically significant with a p-value below 0.05. This is the only statistically significant result in this event in all event windows. On this date, the final documents for the Basel III were announced. The lack of more statistically significant results could mean that the market already knew what to expect from Basel III so the majority of the information was not material. The only inference that can be made from the results is that on event window [-1,+1] Model 1 (T/T) banks are expected to have negative abnormal returns of -0.539%.

Table 4.4.3.1 – OLS multiple regression with business models as dummy variables and ARs and CARs as dependent variables.

OLS multiple regression analysis of AR and CAR with business models as independent variables

	Event 1 - 30/03/2009			Event 2 - 17/12/2009			Event 3 - 16/07/2010		
Date	AR [0]	CAR [-3,+3]	CAR [-1,+1]	AR [0]	CAR [-3,+3]	CAR [-1,+1]	AR [0]	CAR [-3,+3]	CAR [-1,+1]
In-ter-cept	-0.3688 (0.36862)	2.95184*** (0.82852)	-0.4752 (0.53543)	-0.1207 (0.22958)	-3.6275*** (0.60983)	-1.0719*** (0.33196)	1.08882*** (0.17222)	1.24299** (0.50038)	2.46744*** (0.54310)
Mod el 2	-1.2933* (0.72694)	0.17322 (1.63386)	-0.3437 (1.05588)	0.33964 (0.45275)	1.81968 (1.20261)	1.42712** (0.65463)	-0.6469 (0.39147)	-0.7840 (1.13739)	-0.5461 (1.23449)
Mod el 3	-1.4579** (0.56730)	0.41307 (1.27506)	-0.8388 (0.82401)	0.15741 (0.35332)	0.81706 (0.93851)	0.36974 (0.51087)	-0.3861 (0.32820)	-0.7054 (0.95357)	-0.6970 (1.03497)
Mod el 4	-2.6920 (1.91545)	9.28025** (4.30512)	1.55862 (2.78219)	0.13307 (1.19297)	0.03182 (3.16879)	-0.9163 (1.72492)	0.65405 (1.00915)	4.86738* (2.93199)	2.73891 (3.18229)
R Sq.	0,05099	0,02816	0,00933	0,00375	0,01514	0,03197	0,02483	0,02394	0,00880
Obs.	165	165	165	165	165	165	165	165	165

Standard error in parenthesis. * p<0.10; ** p<0.05; *** p< 0.01

OLS multiple regression analysis of AR and CAR with business models as independent variables

Date	Event 4 - 26/07/2010			Event 5 - 12/09/2010			Event 6 - 16/12/2010		
	AR [0]	CAR [-3,+3]	CAR [-1,+1]	AR [0]	CAR [-3,+3]	CAR [-1,+1]	AR [0]	CAR [-3,+3]	CAR [-1,+1]
In-ter-cept	0.66966*** (0.21122)	1.50041*** (0.52751)	1.31200 *** (0.40944)	0.21481 (0.19890)	-0.0932 (0.40886)	-0.2180 (0.28542)	0.14043 (0.14486)	-1.3370 (0.40885)	-0.5393** (0.24254)
Mod el 2	0.68234 (0.48013)	1.42087 (1.19905)	2.33036** (0.93067)	0.18097 (0.45211)	0.13755 (0.92935)	0.79987 (0.64877)	-0.2575 (0.32929)	-1.3233 (0.92934)	-0.6875 (0.55131)
Mod el 3	0.06400 (0.40253)	1.05355 (1.00526)	0.84165 (0.78026)	1.07593*** (0.37904)	1.09439 (0.77915)	1.20122** (0.54392)	-0.2526 (0.27607)	-0.0994 (0.77914)	-0.1622 (0.46221)
Mod el 4	-1.5912 (1.23768)	0.06534 (3.09094)	-1.7429 (2.39911)	-0.1295 (1.16547)	-1.3750 (2.39570)	1.14645 (1.67243)	-1.4030 (0.84885)	-4.5766 (2.39569)	-0.2561 (1.42119)
R Sq.	0,02408	0,01259	0,04424	0,04874	0,01521	0,03379	0,02171	0,03254	0,00963
Obs.	165	165	165	165	165	165	165	165	165

Standard error in parenthesis. * p<0.10; ** p<0.05; *** p< 0.01

4.4.3.2 – Multiple regression with business models and the control independent variables and results

A multiple regression with all the variables previously discussed is now conducted to provide a more robust regression model with more explanatory independent variables in an effort to obtain a more complete regression model.

The equation for the OLS multiple regression is the following:

Equation 4.4.3.2 – OLS Multiple regression of ARs and CARs with all independent variables including business models as independent variables.

$$AR_{it}/CAR_{it} = \alpha + \beta_1 Model2 + \beta_2 Model3 + \beta_3 Model4 + \beta_4 MkCap + \beta_5 RA + \beta_6 RE + \beta_7 E/A$$

This regression has a higher explanatory R-Squared values than the previous regressions, however it can still be considered to have relatively low explanatory power. R-Squared results for these regressions range from 0.009 to 0.21.

Event 1 – 30 of March 2009

On event 1, the event window [0] had the highest number of statistically significant coefficients. On window [0], Model 3 (T/NT) has a statistically significant coefficient of -1.35 and Model 4 (NT/NT) has a statistically significant coefficient of -3.41. These results indicate that Model 3 (T/NT) banks are expected to have lower AR by -1.35% than Model 1 (T/T) banks and Model 4 (NT/NT) banks are expected to have lower AR by -3.41% than Model 1 (T/T) banks. These results suggest that the less traditional Model 3 (T/NT) and Model 4 (NT/NT) are expected to have lower ARs than Model 1 (T/T) banks which was an expected result because the announcement place emphasis on regulating the less traditional forms of banking that were lightly regulated prior to Basel III. On the larger window [-3,+3], the intercept term of 2.48 is statistically significant with a p-value below 0.10 and Model 4 (NT/NT) coefficient is 10.70 with a p-value below 0.10 so Model 4 (NT/NT) banks are expected to have higher AR than Model 1 (T/T) banks by 10.70%.

The market cap coefficient of -0.059 on window [0] is statistically significant with a p-value below 0.01. This tells us that the AR is expected to decrease by -0.059% per one billion increase in market cap. These results show that a large swing in market cap does not translate in a large change in AR, so according to the model, size does not play a big part in

the variation of abnormal returns in this announcement. Also, the fact that the coefficient is negative tells us that the larger the bank, the lower expected AR, this could be explained by the additional capital systemically important banks could be expected to hold. The market cap coefficient on window [-3,+3] is also significant at -0.0401 with a p-value below 0.10. Return on equity also has a statistically significant coefficient of 0.0643 with a p-value below 0.10. This result can be interpreted as a 1% increase in return on equity translates into an increase of AR by 0.0643% which is an intuitive result as more profitable banks could be expected to have higher AR after the announcement than less profitable banks.

Event 2 – 17 of December 2010

On event 2, the intercept terms are -5.72 and -1.15 for windows [-3,+3] and [-1,+1] respectively and statistically significant with a p-value below 0.01 and 0.05 respectively. Model 2 (NT/T) also have statistically significant coefficients. The coefficient for window [-3,+3] is 1.97 and for window [-1,+1] is 1.48. From this we can conclude that be Model 2 (NT/T) banks are expected to have higher AR than Model 1 (T/T) banks on Event 2. On this date, the BCBS released the first major consultative document that would become Basel III, according to the results, the market considered the new framework to be more detrimental to Model 1 (T/T) banks than to Model 2 (NT/T) Banks. A possible explanation could be that the market was expecting stricter regulation for non-traditional banks than the one communicated on this announcement.

On event window [-3,+3], the ROE coefficient of 0.14 is positive and statistically significant with a p-value below 0.05. This means that a 1% increase in ROE translates into an increase of 0.14% in abnormal returns. Also on window [-3,+3], the equity/assets coefficient of 20.28 is positive and statistically significant with a p-value below 0.01. This can be interpreted as a 1% increase in equity over assets represents a 0.20% increase in CAR.

Event 3 – 16 of July 2010

On event 3, the intercept terms that represent Model 1 (T/T) banks are statistically significant in all event windows. The intercept terms are 1.73, 2.29, and 3.93 for windows [0], [-3,+3] and [-1,+1] respectively. On this date the countercyclical capital buffer was introduced, and according to the results, the market believes this capital requirement will benefit traditional banks or Model 1 (T/T) banks.

ROA coefficients are positive and statistically significant on window [0] and [-3,+3] at 0.30 and 1.18. According to these coefficients, as ROA increases, so increases ARs. This result is particularly high on window [-3,+3]. Surprisingly ROE coefficients are negative and also statistically significant, so as ROE increases, AR decreases. The equity/assets has a coefficient of -4.88 on window [0] and is significant with p-value below 0.05. It can be concluded that a 1% increase in equity over assets translates into a reduction of AR by -0.049%.

Event 4 – 26 July 2010

On event 4, the intercept terms that represent Model 1 (T/T) banks are statistically significant in all event windows. The intercept terms are 1.13, 2.83, and 2.52 for windows [0], [-3,+3] and [-1,+1] respectively. According to the results, the market benefited Model 1 (T/T) banks after this announcement as the expected ARs are positive. Model 2 (NT/T) has a coefficient of 1.89 with a p-value significant at the 0.10 level. This means that Model 2 (NT/T) banks are expected to have larger CAR than Model 1 (T/T) banks by 1.89%. As mentioned, this announcement focused mostly on the definition agreement of the liquidity reform that would make part in Basel III. The market seems to be rewarding these reforms.

Almost all coefficients on the profitability variables are statistical significant. On ROA the coefficient of 0.40 on window [0] is significant with a p-value below 0.10 and the coefficient of 1.04 on window [-3,+3] is significant with a p-value also below 0.10. The positive coefficients can be interpreted as ROE increases, so does AR. Inversely, the coefficients for ROE are negative. The ROE coefficients are -0.05, -0.09 and -0.06 on windows [0], [-3,+3] and [-1,+1] respectively. This implies that an increase in ROE reduces the AR results. Equity/assets coefficients are also significant in all event windows being -5.43, -17.37, and -12.65 for windows [0], [-3,+3] and [-1,+1] respectively. The coefficients are negative which implies that an increase in the equity over assets ratio translates into a reduction of AR.

Event 5 – 12 of September 2010

On event 5, the intercept term of 1.03 on window [0] is statistically significant at the 0.01 level. Model 3 (T/NT) coefficients of 0.93 and 1.19 on windows [0] and [-1,+1] respectively and are both significant at the 0.05 level. These results mean that Model 3 (T/NT) banks are expected higher AR than Model 1 (T/T) in window [0] and in window [-1,+1]. The remaining business model coefficients are not statistically significant. On the 12th of Septem-

ber 2010 the BCBS announced the introduction of higher capital standards into the framework and also presented a phase-in schedule for the implementation of Basel III. The coefficients indicate the impact of this announcement was positive on the AR of the banks, Model 3 (NT/T) benefiting more than Model 1 (T/T) banks. A possibility would be that the market is benefiting the phase-in grace period given to banks given them more time to be fully Basel III compliant.

The return on assets coefficient of 0.33 is positive and statistically significant at the 0.10 level. The coefficient is positive which means that a 1% increase in return on assets corresponds an increase of 0.33% of AR. The return on equity is also positive with a coefficient of 0.08 which can be understood as a 1% increase in return on equity corresponds to an increase of 0.08% of AR. The equity over assets coefficient of -10.19 is statistically significant at the 0.01 level. A 1% increase in return on assets ration corresponds to a decrease of 0.10% in AR

Event 6 – 16 of December 2010

On Event 6, only the intercept term on window [-3,+3] of -2.82 is statistically significant at the 0m01 level. Model 4 (NT/NT) coefficients -1.96 and -6.05 on window [0] and [-3,+3] respectively and are statistically significant at the 0.05 level. These results reveal that it is expected for Model 4 (NT/NT) banks to have lower AR than Model 1 (T/T) banks by -1.96% in case of window [0] and -6.05 in case of window [-3,+3]. This event was market by the introduction of the final Basel III documents, and similarly as in the event study section, the impact was negative but did not produce a large number of statistically significant results.

The market capitalization coefficient of -0.013 is significant at the 0.10 level in window [0]. The coefficient being negative and according to the model, a 1 billion increase in market capitalization translates into a reduction of AR by -0.013%. On window [-3,+3], the market capitalization coefficient of -0.043 is also statistically significant at the level of 0.05. Despite the market capitalization coefficients being statistically significant for two event windows, the impact on AR is relatively low. Return on assets has a statistically significant coefficient of -0.88 on event window [-3,+3]. This coefficient is rather significant because a 1% increase in return on assets decreases AR by -0.88%. Event window [0] has a return on equity coefficient of -0.037 statistically significant at the 0.01 level. Event window [-3,+3] has a return on equity coefficient of 0.119 statistically significant at the 0.01 level. Event window [-3,+3] has an equity over assets coefficient of 16.65 statistically significant at the

0.01 level. This means that an increase in the equity over assets ratio translates into an increase of AR by 0.1665% according to the regression model.

Table 4.4.3.2 – Multiple regression of ARs and CARs on all independent variables

Multiple OLS regression of ARs and CARs on all independent variables

Date	Event 1 - 30/03/2009			Event 2 - 17/12/2009			Event 3 - 16/07/2010		
	AR [0]	CAR [-3,+3]	CAR [-1,+1]	AR [0]	CAR [-3,+3]	CAR [-1,+1]	AR [0]	CAR [-3,+3]	CAR [-1,+1]
Intercept	-0.2099	**2.48013***	-1.0907	0.03052	**-5.7220*****	**-1.1533****	**1.7276*****	**2.2034****	**3.9316*****
	(0.55315)	(1.29545)	(0.83375)	(0.36325)	(0.91921)	(0.52168)	(0.2797)	(0.8803)	(0.9428)
Model 2	-1.1232	0.19808	-0.2170	0.31483	**1.97436***	**1.47825****	-0.4665	-0.2994	-0.2320
	(0.69836)	(1.63551)	(1.05262)	(0.45861)	(1.16051)	(0.65863)	(0.37568)	(1.18231)	(1.26625)
Model 3	**-1.3534****	0.59532	-0.7391	0.13655	0.81772	0.37443	-0.2614	-0.2792	-0.4898
	(0.54702)	(1.28107)	(0.82450)	(0.35922)	(0.90901)	(0.51590)	(0.31400)	(0.98821)	(1.05836)
Model 4	**-3.4054***	**10.6958****	1.51431	0.32058	-1.2909	-1.4841	1.13236	3.74205	3.88399
	(1.89632)	(4.44104)	(2.85826)	(1.24531)	(3.15123)	(1.78844)	(1.08154)	(3.40371)	(3.64535)
Market Cap	**-0.0593*****	0.02076	**-0.0401***	0.00020	-0.0372	-0.0151	-0.0120	-0.0167	-0.0208
	(0.01503)	(0.03521)	(0.02266)	(0.00987)	(0.02498)	(0.01418)	(0.00829)	(0.02609)	(0.02795)
Ret. Assets	-0.4301	-0.7227	-0.5069	0.21158	-0.8512	-0.1563	**0.29955***	**1.17658****	0.68641
	(0.37271)	(0.87286)	(0.56177)	(0.24475)	(0.61935)	(0.35150)	(0.16046)	(0.50499)	(0.54084)
Ret. Equity	**0.06430***	-0.0466	0.04042	-0.0183	**0.13824****	0.03904	**-0.0595*****	**-0.1033****	**-0.1191*****
	(0.03419)	(0.08007)	(0.05153)	(0.02245)	(0.05681)	(0.03224)	(0.01278)	(0.04024)	(0.04310)
Equity/Assets	0.26497	9.39156	8.84009	-1.5169	**20.2822*****	0.31457	**-4.8799****	-11.723	-12.371
	(4.21205)	(9.86429)	(6.34867)	(2.76605)	(6.99942)	(3.97243)	(2.38555)	(7.50752)	(8.04048)
R Sq	0.1508	0.0558	0.0454	0.0089	0.1108	0.0499	0.2089	0.0710	0.0814
Obs.	165	165	165	165	165	165	165	165	165

Standard error in parenthesis. * p<0.10; ** p<0.05; *** p< 0.01

Multiple OLS regression of ARs and CARs on all independent variables

Date	Event 4 - 26/07/2010			Event 5 - 12/09/2010			Event 6 - 16/12/2010		
	AR [0]	CAR [-3,+3]	CAR [-1,+1]	AR [0]	CAR [-3,+3]	CAR [-1,+1]	AR [0]	CAR [-3,+3]	CAR [-1,+1]
Intercept	**1.13398*****	**2.83196*****	**2.52455*****	**1.03119*****	-0.8286	-0.2667	0.10259	**-2.8230*****	-0.6024
	(0.36860)	(0.92259)	(0.71272)	(0.34246)	(0.71621)	(0.50298)	(0.24309)	(0.68023)	(0.43344)
Model 2	0.62107	1.13344	1.88865*	0.02105	-0.1361	0.63897	-0.0027	-0.8720	-0.4780
	(0.49504)	(1.23905)	(0.95719)	(0.45993)	(0.96188)	(0.67551)	(0.32647)	(0.91355)	(0.58212)
Model 3	0.12785	1.06779	0.63990	**0.93080****	0.90000	**1.18529****	-0.0349	-0.0702	-0.1296
	(0.41376)	(1.03563)	(0.80004)	(0.38442)	(0.80396)	(0.56460)	(0.27287)	(0.76357)	(0.48655)
Model 4	-1.4587	0.65384	0.27397	0.81277	-1.8082	0.51035	**-1.9623****	**-6.0504****	-0.3213
	(1.42514)	(3.56705)	(2.75561)	(1.32408)	(2.76911)	(1.94469)	(0.93987)	(2.62999)	(1.67583)
Market Cap	0.01053	0.03389	0.02993	0.00979	0.01763	0.01942	**-0.0134***	**-0.0426****	-0.0190
	(0.01092)	(0.02734)	(0.02112)	(0.01015)	(0.02123)	(0.01491)	(0.00720)	(0.02016)	(0.01284)
Ret. Assets	**0.39554***	**1.03739***	0.35620	**0.32776***	-0.3784	0.29306	0.14974	**-0.8819****	-0.1251
	(0.21144)	(0.52922)	(0.40883)	(0.19644)	(0.41083)	(0.28852)	(0.13944)	(0.39019)	(0.24863)
Ret. Equity	**-0.0464*****	**-0.0889****	**-0.0623***	-0.0135	0.07713**	0.00914	**-0.0369*****	**0.11857*****	0.01242
	(0.01685)	(0.04217)	(0.03258)	(0.01565)	(0.03274)	(0.02299)	(0.01111)	(0.03109)	(0.01981)
Equity/Assets	**-5.4282***	**-17.369****	**-12.654****	**-10.192*****	5.24039	-2.8490	1.84423	**16.6521*****	1.65445
	(3.14342)	(7.86779)	(6.07800)	(2.92051)	(6.10779)	(4.28938)	(2.07305)	(5.80093)	(3.69636)
R Sq	0.0862	0.0713	0.1095	0.1329	0.0708	0.0774	0.1530	0.1765	0.0275
Obs.	165	165	165	165	165	165	165	165	165

Standard error in parenthesis. * p<0.10; ** p<0.05; *** p< 0.01

5 - Conclusion

Basel III will bring large changes to the world banking landscape. This study tries to assess to what extent these changes will benefit certain types of banks in Europe more than others. To investigate this question, this study distinguishes between bank business models using a k-means clustering model based on the balance sheet structure of each bank. Assets and liabilities were analyzed and grouped into traditional vs non-traditional categories. Each bank was given two values: percentage of traditional assets (loans to customers) of total earning assets and percentage of traditional liabilities (deposits) of total funding liabilities. After these two ratios were computed and assigned to all banks in the sample, the k-means clustering algorithm was run to identify and assign business models to all banks. The end result are 4 different banking business models: Model 1 with a traditional asset structure and a traditional liability structure, Model 2 with a non-traditional asset structure and a traditional liability structure, Model 3 with a traditional asset structure and a non-traditional liability structure, and Model 4 with a non-traditional asset structure and a non-traditional liability structure. The majority of banks in the sample belong to Model 1 (T/T) category with 103 banks. Model 2 (NT/T) has 28 banks, Model 3 (T/NT) has 39 banks, and the model with the least number of banks was Model 4 (NT/NT) with only 3 banks.

Following the business model categorization, an event study was conducted to assess the extent to which business models react differently to Basel III announcements. Six press release dates were selected, each date with different developments in the designing of Basel III. This study found that the reactions to the announcements were not homogenous, some announcements resulted in positive abnormal returns while other announcements resulted in negative abnormal returns. What was surprising and not expected before conducting the study was the large number of positive abnormal returns in a number of events. These results could indicate that the market expects Basel III to help banks achieve higher returns in the long-term. Another possibility could be that the market was expecting a stricter framework prior to the announcement.

Following the event study analysis, and to understand if the models identified in this thesis can be used to explain abnormal returns, a regression analysis is conducted. Apart from business models, the following control variables were used to build a robust regression model: market capitalization, return on assets, return on equity, and equity over assets. The R-Squared values obtained from the regressions are relatively low, ranging from 0.009 to 0.21,

so it can be concluded that business models and the control variables have low explanatory power when explaining the abnormal returns.

Summarizing the empirical results obtained for the events selected:

Event 1 on the 30th of March 2009 expressed a desire by BCBS to improve and expand the Basel II framework. The new framework had the objective of increasing capital requirements, include liquidity buffers and expand into non-regulated activities motivated by the financial crisis. From the statistical significant results in this event study, it could be concluded that the value of Model 3 (T/NT) banks decreased in response to this announcement. Model 3 (T/NT) is a non-traditional model, so the result is in line with the expectation prior to conducting the study as non-traditional models would be expected to be negatively impacted more than traditional models. From the regression, it was concluded that Model 3 (T/NT) and Model 4 (NT/NT) banks are expected to have lower abnormal returns than Model 1 (T/T) banks as a result of announcement 1. However, the larger event window predicts positive abnormal returns for Model 1 (T/T) and even higher for Model 4 (NT/NT) banks.

Event 2 on the 17th of December 2009 provided more details into Basel III by issuing the first consultative documents that were to become the new Basel III framework. The statistically results suggest that the market expected lower future returns for the aggregate of banks in the sample and in particular for Model 1(T/T) banks after this announcement. The regression analysis also predicted negative abnormal returns for Model 1 (T/T) banks and Model 2 (NT/T) are expected to have higher abnormal returns than Model 1 (T/T) banks. The market seemed to be penalizing the traditional Model 1 (T/T) banks.

Event 3 on the 16th of July 2010 announced general progress in the regulatory reform package and introduced the countercyclical capital buffer. The statistically significant results showed positive abnormal returns after this announcement, the largest increase was in Model 1 (T/T) and Model 2 (NT/T) banks. Both models have a traditional liability structure, so the market could be rewarding this characteristic. There is a possibility that the market sees the countercyclical capital buffer a measure that will improve the bank's bottom line in the long-term. The regressions predicted positive abnormal returns for Model 1(T/T) banks.

Event 4 on the 26th of July 2010 the BCBS announced that it reached a broad agreement on the capital and liquidity reform package. The event study conducted has four statistically significant results. The aggregate of banks in the sample, Model 2 (NT/T) and Model 3

(T/NT) have positive and statistically significant results. Model 2 (NT/T) had the highest statistically significant abnormal returns. These results suggest that the market is rewarding liquidity regulation introduced by Basel III, benefiting Model 2 (NT/T) banks the most. On the regressions model, the results are similar than the event study. Model 1 (T/T) banks expected to have positive abnormal returns and Model 2 (NT/T) banks are expected to have higher abnormal returns than Model 1(T/T) banks.

Event 5 on the 12th of September of 2010, the BCBS announced higher capital requirements and provided a phase-in schedule for the implementation of Basel III. The event study conducted had one statistically significant result of 2.24 for Model 3 (T/NT) on window [0]. The lack of statistically significant results in this announcement could be explained by the possibility that the market was already expecting this information, so the announcement had no effect. The regression model showed an expected positive abnormal return for Model 1 (T/T) banks and Model 3 (T/NT) is expected to have higher abnormal returns than Model 1 (T/T) banks. A possible explanation for this result is that the market could be rewarding the fact that the implementation will be phased-in giving more time for banks to prepare their compliance efforts.

Event 6 on the 16th of December 2010 represented the full documents of Basel III. The event study conducted had two statistically significant negative results in window [-3,+3] for the aggregate of banks in the sample and for Model 2 (NT/T) banks. The low level of statistically significant results in window [0] could mean that the market already knew what to expect form Basel III reform, so the announcement did not provide a large amount of new information. However the statistically significant results in the larger window could mean that the market perceived the final version of Basel III to negatively impact banks and Model 2 (NT/T) banks the most. Model 2 (NT/T) has a non-traditional asset structure so the market could be penalizing this characteristic.

The results show that there was not a homogenous response to Basel III and therefore it is not possible to predict what was the overall market response to Basel III. However, the event study did show some patterns. Some banks react more prominently than others to some announcements, but this could be due to factors other than business models, as the regression R-Squared results had low explanatory power. It was clear that business models cannot be taken in isolation to predict the effects of Basel III as there are more dynamics at play that could influence the value of exchange traded European banks.

Answering the question posed in the introduction: Did Basel announcement had negative impact on firm value of European banks? And did Basel III benefited some models more than others? The answer is inconclusive for both questions because the results were not consistent in all the events analyzed. The first event and the last event have 626 days apart from each other, a great deal of expectations and adaptations to Basel III occurred during this period, this could be an explanation for the results not being homogenous among event dates which made the results harder to interpret.

5.1 – Limitations

There were a number of limitations to this study that will be listed here. First, when conducting an event study confounding effects can be present especially on the longer event windows. This can distort the cumulative abnormal returns which will make the subsequent tests not valid as they do not capture the event under study. Second, the events selected have several developments, so it can be hard to exactly identify which part of the announcement caused the reaction. Third, there are several methods for identifying and assigning business models. Only one method was used in this study due to time constraints, however using more methods can benefit a study that focuses on bank business models. Fourth, the sample was comprised only of exchange traded banks and it was limited to data availability narrowing down the sample to a relatively low number of banks. Fifth, this study suffers from survivorship bias. The sample of banks in the database only included banks that were operating as of 2017. And sixth, the measures for the control variables in the regression for profitability, size and capitalization level were somewhat crude, better data could provide better metrics for these variables.

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Appendix

Appendix 1 - Basel Committee of Banking Supervision

Basel I capital requirements weights (BCBS, 1988)

Risk weights by category of on-balance-sheet asset	
0%	
(a)	Cash
(b)	Claims on central governments and central banks denominated in national currency and funded in that currency
(c)	Other claims on OECD central governments and central banks
(d)	Claims collateralised by cash of OECD central government securities or guaranteed by OECD central governments
0, 10, 20, or 50% (at national discretion)	
(a)	Claims on domestic public sector entities excluding central government and loans guaranteed by such entities
20%	
(a)	Claims on multilateral development banks (IBRD IADB AsDB AfDB EIB) and claims guaranteed by or collateralised by securities issued by such banks
(b)	Claims on banks incorporated in the OECD and loans guaranteed by OECD incorporated banks
(c)	Claims on banks incorporated in countries outside the OECD with a residual maturity of up to one year and loans with a residual maturity of up to one year guaranteed by banks incorporated in countries outside the OECD
(d)	Claims on non-domestic OECD public-sector entities excluding central government and loans guaranteed by such entities
(e)	Cash items in process of collection
50%	
(a)	Loans fully secured by mortgage on residential property that is or will be occupied by the borrower or that is rented
100%	
(a)	Claims on the private sector
(b)	Claims on banks incorporated outside the OECD with a residual maturity of over one year
(c)	Claims on central governments outside the OECD (unless denominated in national currency - and funded in that currency - see above)
(d)	Claims on commercial companies owned by the public sector
(e)	Premises plant and equipment and other fixed assets
(f)	Real estate and other investments (including non-consolidated investment participations in other companies)
(g)	Capital instruments issued by other banks (unless deducted from capital)
(h)	all other assets

Pillar 2 Supervisory review key principles (BCBS, 2004)

Principle 1	Banks should have a process for assessing their overall capital adequacy in relation to their risk profile and a strategy for maintaining their capital levels.
Principle 2	Supervisors should review and evaluate banks' internal capital adequacy assessments and strategies, as well as their ability to monitor and ensure their compliance with regulatory capital ratios. Supervisors should take appropriate supervisory action if they are not satisfied with the result of this process. Principle 3: Supervisors should expect banks to operate above the minimum regulatory capital ratios and should have the ability to require banks to hold capital in excess of the minimum.
Principle 3	Supervisors should expect banks to operate above the minimum regulatory capital ratios and should have the ability to require banks to hold capital in excess of the minimum.
Principle 4	Supervisors should seek to intervene at an early stage to prevent capital from falling below the minimum levels required to support the risk characteristics of a particular bank and should require rapid remedial action if capital is not maintained or restored

Phase-in arrangements Basel III (BCBS 2010)

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Leverag ratio	Supervisory monitoring	Parallel run 1 Jan 2013 – 1 Jan 2017. Disclosure starts 1 Jan 2015		Migration to Pillar 1					
Minimum common equity capital ratio			3.5%	4%	4.5%	4.5%	4.5%	4.5%	4.5%
Capital conservation buffer						0.625%	1.25%	1.875%	2.5%
Minimum common equity plus capital conservation buffer			2.5%	4%	4.5%	5.125%	5.75%	6.375%	7%
Phase in of deductions from CET1 (including amounts exceeding the limit for STAs, MSRs and financials)				20%	40%	60%	80%	100%	100%
Minimum Tier 1 Capital			4.5%	5.5%	6%	6%	6%	6%	6%
Minimum Total Capital			8%	8%	8%	8%	8%	8%	8%
Minimum Total Capital plus conservation buffer			8%	8%	8%	8.625%	9.25%	9.875%	10.5%
Capital instruments that no longer qualify as non-core Tier 1 capital or Tier 2 capital			Phased out over 10 year horizon beginning 2013						
Liquidity coverage ratio	Observation period begins				Introduce minimum standard				
Net stable funding ratio		Observation period begins						Introduce minimum standard	

Appendix 2 - Business Models

Bank Business Model list 2010 obtained by running k-means clustering algorithm:

RIC CODE	Bank Name	Business Model
1VUB02AE.BV	Vseobecna Uverova Banka as	Model 1
4CF.BB	Central Cooperative Bank AD	Model 1
5BN.BB	Bulgarian American Credit Bank AD	Model 3
5F4.BB	First Investment Bank AD	Model 1
ACBr.AT	Alpha Bank SA	Model 1
AIKB.BEL	Agroindustrijsko Komercijalna Banka Aik Banka ad Beograd	Model 1
AKTRV.HE	Aktia Bank Abp	Model 3
ALBAV.HE	Alandsbanken Abp	Model 1
ALBK.I	Allied Irish Banks PLC	Model 1
AMBr.AT	T Bank SA	Model 1
ARLG.DE	Aareal Bank AG	Model 1
BAER.S	Julius Baer Gruppe AG	Model 2
BAMI.MI	Banco Bpm SpA	Model 3
BARC.L	Barclays PLC	Model 2
BAVL.PFT	Raiffeisen Bank Aval' PAT	Model 1
BBPI.LS	Banco Bpi SA	Model 1
BBVA.MC	Banco Bilbao Vizcaya Argentaria SA	Model 1
BC.S	Bank Coop AG	Model 1
BCGE.S	Banque Cantonale de Geneve	Model 2
BCJ.S	Banque Cantonale du Jura SA	Model 1
BCP.LS	Banco Comercial Portugues SA	Model 1
BCVN.S	Banque Cantonale Vaudoise	Model 3
BEKN.S	Berner Kantonalbank AG	Model 1
BFE.MI	Banca Finnat Euramerica SpA	Model 2
BGN.MI	Banca Generali SpA	Model 2
BHW.WA	Bank Handlowy w Warszawie SA	Model 2
BIM.MI	Banca Intermobiliare di Investimenti e Gestioni SpA	Model 1
BKIR.I	Bank of Ireland	Model 1
BKOM.PR	Komercni Banka as	Model 1
BKT.MC	Bankinter SA	Model 3
BLKB.S	Basellandschaftliche Kantonalbank	Model 1
BMPS.MI	Banca Monte dei Paschi di Siena SpA	Model 3
BNAB.BR	National Bank of Belgium	Model 3
BNORDIK.CO	BankNordik P/F	Model 1
BNPP.PA	BNP Paribas SA	Model 2
BOAr.AT	Attica Bank SA	Model 1
BOGr.AT	Bank of Greece	Model 3
BOPr.AT	Piraeus Bank SA	Model 1
BOSP.WA	Bank Ochrony Srodowiska SA	Model 1
BOV.MT	Bank of Valletta PLC	Model 1
BPSI.MI	Banca Popolare di Sondrio ScpA	Model 1
BPSP.MI	Banca Popolare di Spoleto SpA	Model 1
BSKP.S	Basler Kantonalbank	Model 1
BSPB.MM	Bank Sankt-Peterburg PAO	Model 1
BZW.WA	Bank Zachodni WBK SA	Model 1
CABK.MC	Caixabank SA	Model 2
CADNi.PA	Caisse Regionale de Credit Agricole Mutuel de Nord de France SC	Model 1
CAGR.PA	Credit Agricole SA	Model 3
CAHM.MC	Fundacion Caja Mediterraneo	Model 2
CAIF.PA	Caisse Regionale de Credit Agricole Mutuel de Paris et d'Ile de France	Model 1
CALCi.PA	Caisse Regionale de Credit Agricole Mutuel Atlantique Vendee SC	Model 1
CAT31.PA	Caisse Regionale de Credit Agricole Mutuel Toulouse 31 SC	Model 1
CBKG.DE	Commerzbank AG	Model 3
CBRO.L	Close Brothers Group PLC	Model 3
CC.PA	Credit Industriel et Commercial SA	Model 2
CCNP.PA	Caisse Regionale de Credit Agricole Mutuel de Normandie Seine SC	Model 1
CDBG.DE	Comdirect Bank AG	Model 2
CIV.PA	Caisse Regionale de Credit Agricole Mutuel d'Ille-et-Vilaine SC	Model 1
CMO.PA	Credit Agricole du Morbihan SC	Model 1
CRAP.PA	Caisse Regionale de Credit Agricole Mutuel Alpes Provence	Model 1
CRBP2.PA	Caisse Regionale de Credit Agricole Mutuel Brie Picardie	Model 1
CRDI.MI	UniCredit SpA	Model 1
CRGI.MI	Banca Carige SpA Cassa di Risparmio di Genova e Imperia	Model 3
CRLA.PA	Caisse Regionale de Credit Agricole Mutuel du Languedoc SC	Model 1
CRLO.PA	Caisse Regionale de Credit Agricole Mutuel Loire Haute-Loire	Model 1
CRSU.PA	Caisse Regionale de Credit Agricole Mutuel Sud Rhone Alpes	Model 1
CRTO.PA	Caisse Regionale de Credit Agricole Mutuel de la Touraine et du Poitou SCACV	Model 1
CSGN.S	Credit Suisse Group AG	Model 2
DANSKE.CO	Danske Bank A/S	Model 3
DBKGn.DE	Deutsche Bank AG	Model 2
DESI.MI	Banco di Desio e della Brianza SpA	Model 3
DEXI.BR	Dexia SA	Model 3
DJUR.CO	Djurslands Bank A/S	Model 1

DNB.OL	DNB ASA	Model 3
DVBG.F	Dvb Bank SE	Model 3
EFGN.S	EFG International AG	Model 2
EMBI.MI	Credito Emiliano SpA	Model 1
EMII.MI	Bper Banca SpA	Model 3
ERST.VI	Erste Group Bank AG	Model 1
EURBr.AT	Eurobank Ergasias SA	Model 1
FHBK.BU	FHB Jelzalogbank Nyrt	Model 3
GPSr.AT	TT Hellenic Postbank SA	Model 2
GRKP.S	Graubuendner Kantonalbank	Model 1
GTN.WA	Getin Holding SA	Model 1
HBLN.S	Hypothekarbank Lenzburg AG	Model 1
HBNK.CY	Hellenic Bank PCL	Model 1
HELG.OL	Helgeland Sparebank	Model 3
HSB.MT	HSBC Bank Malta PLC	Model 3
HSBA.L	HSBC Holdings PLC	Model 2
HVID.CO	Hvidbjerg Bank A/S	Model 1
IKBZ.SJ	ASA Banka dd Sarajevo	Model 2
IL0A.I	Permanent TSB Group Holdings PLC	Model 2
INGA.AS	ING Groep NV	Model 3
INGP.WA	ING Bank Slaski SA	Model 1
ISP.MI	Intesa Sanpaolo SpA	Model 3
JMBN.BEL	Jubmes Banka ad Beograd	Model 2
JUTBK.CO	Jutlander Bank A/S	Model 1
JYSK.CO	Jyske Bank A/S	Model 1
KASNc.AS	KAS Bank NV	Model 2
KBC.BR	KBC Groep NV	Model 2
KMB.MKE	Komercijalna Banka AD Skopje	Model 1
KMBN.BEL	Komercijalna Banka ad Beograd	Model 1
LLOY.L	Lloyds Banking Group PLC	Model 3
LOCI.PA	Locindus SA	Model 4
LOLB.CO	Lollands Bank A/S	Model 1
LUKN.S	Luzerner Kantonalbank AG	Model 1
LUXORb.CO	Investeringsselskabet Luxor A/S	Model 4
MDBI.MI	Mediobanca Banca di Credito Finanziario SpA	Model 3
MILP.WA	Bank Millennium SA	Model 1
MING.OL	Sparebank 1 SMN	Model 3
MNBA.CO	Moens Bank A/S	Model 1
NBGr.AT	National Bank of Greece SA	Model 1
NDA.ST	Nordea Bank AB	Model 3
NONG.OL	Sparebank 1 Nord-Norge	Model 1
NORDJB.CO	Nordjyske Bank A/S	Model 1
OJBA.CO	Oestjydsk Bank A/S	Model 1
OLBG.F	Oldenburgische Landesbank AG	Model 1
OTPB.BU	OTP Bank Nyrt	Model 1
PBZ.ZA	Privredna Banka Zagreb dd	Model 1
PCVI.MI	Banca Piccolo Credito Valtellinese SpA	Model 1
PEO.WA	Bank Polska Kasa Opieki SA	Model 1
PKO.WA	Powszechna Kasa Oszczednosci Bank Polski SA	Model 1
POP.MC	Banco Popular Espanol SA	Model 1
PRO.MI	Banca Profilo SpA	Model 2
QB7G.DE	Quirin Bank AG	Model 1
RBIV.VI	Raiffeisen Bank International AG	Model 1
RBS.L	Royal Bank of Scotland Group PLC	Model 2
RILBA.CO	Ringkjoebing Landbobank A/S	Model 1
RLD.S	Edmond de Rothschild Suisse SA	Model 1
ROBCC.BX	Banca Comerciala Carpatica SA	Model 2
ROBRD.BX	BRD Groupe Societe Generale SA	Model 1
ROSB.MM	Rosbank PAO	Model 1
ROTLV.BX	Banca Transilvania SA	Model 1
SAB1L.VL	Siauliu Bankas AB	Model 1
SABE.MC	Banco de Sabadell SA	Model 1
SADG.OL	Sandnes Sparebank	Model 3
SAN.MC	Banco Santander SA	Model 1
SARIn.MI	Banco di Sardegna SpA	Model 1
SBER.MM	Sberbank Rossii PAO	Model 1
SBT.MKE	Stopanska Banka AD Bitola	Model 2
SEBa.ST	Skandinaviska Enskilda Banken AB	Model 3
SGKN.S	St Galler Kantonalbank AG	Model 1
SHBa.ST	Svenska Handelsbanken AB	Model 3
SKJE.CO	Skjern Bank A/S	Model 1
SKUE.OL	Skue Sparebank	Model 1
SNBN.S	Schweizerische Nationalbank	Model 3
SOGN.PA	Societe Generale SA	Model 2
SPMO.OL	Sparebanken More	Model 1
SPNO.CO	Spar Nord Bank A/S	Model 1
SPOG.OL	Sparebanken Ost	Model 3
SRBANK.OL	Sparebank 1 SR Bank ASA	Model 3
STAN.L	Standard Chartered PLC	Model 1
SVEG.OL	Sparebanken Vest	Model 3
SWEDa.ST	Swedbank AB	Model 3
SYDB.CO	Sydbank A/S	Model 1
TOTA.CO	Totalbanken A/S	Model 1
TOTG.OL	Totens Sparebank	Model 3
TUBG.D	HSBC Trinkaus & Burkhardt AG	Model 2
UBI.MI	Unione di Banche Italiane SpA	Model 3
USCB.PFT	Ukrsotsbank PAT	Model 1

VATN.S	Valiant Holding AG	Model 1
VG8G.DE	Varengold Bank AG	Model 4
VJBA.CO	Vestjysk Bank A/S	Model 3
VLAN.AS	Van Lanschot NV	Model 3
VPBN.S	VP Bank AG	Model 2
VTBR.MM	Bank VTB PAO	Model 1
VZRZ.MM	Vozrozhdenie Bank	Model 1
WKB.S	Banque Cantonale du Valais	Model 1
WPBI.VI	Wiener Privatbank SE	Model 1
ZBB.ZA	Zagrebacka Banka dd	Model 1
ZG.S	Zuger Kantonalbank	Model 1

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BIM.MI	Banca Intermobiliare di Investimenti e Gestioni SpA	Model 1
BMED.MI	Banca Mediolanum SpA	Model 1
BMPS.MI	Banca Monte dei Paschi di Siena SpA	Model 3
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EURBr.AT	Eurobank Ergasias SA	Model 3
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CAHM.MC	Fundacion Caja Mediterraneo	Model 2
GTN.WA	Getin Holding SA	Model 1
GRKP.S	Graubuendner Kantonalbank	Model 1
HELG.OL	Helgeland Sparebank	Model 1
HBNK.CY	Hellenic Bank PCL	Model 1
HSB.MT	HSBC Bank Malta PLC	Model 1
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TUBG.D	HSBC Trinkaus & Burkhardt AG	Model 3
HVID.CO	Hvidbjerg Bank A/S	Model 2
HBLN.S	Hypothekarbank Lenzburg AG	Model 2
INGP.WA	ING Bank Slaski SA	Model 1
INGA.AS	ING Groep NV	Model 3
ISP.MI	Intesa Sanpaolo SpA	Model 3
LUXORb.CO	Investeringsselskabet Luxor A/S	Model 1
JMBN.BEL	Jubmes Banka ad Beograd	Model 3
JUTBK.CO	Jutlander Bank A/S	Model 2
JYSK.CO	Jyske Bank A/S	Model 2
KASNc.AS	KAS Bank NV	Model 1
KBC.BR	KBC Groep NV	Model 3
KMBN.BEL	Komercijalna Banka ad Beograd	Model 2
KMB.MKE	Komercijalna Banka AD Skopje	Model 2
BKOM.PR	Komercni Banka as	Model 1
LLOY.L	Lloyds Banking Group PLC	Model 1
LOCI.PA	Locindus SA	Model 3
LOLB.CO	Lollands Bank A/S	Model 1
LUKN.S	Luzerner Kantonalbank AG	Model 1
MBK.WA	MBANK	Model 1
MDBI.MI	Mediobanca Banca di Credito Finanziario SpA	Model 3
MNBA.CO	Moens Bank A/S	Model 1
BNAB.BR	National Bank of Belgium	Model 4
NBGr.AT	National Bank of Greece SA	Model 1
NDA.ST	Nordea Bank AB	Model 4
NORDJB.CO	Nordjyske Bank A/S	Model 1
OJBA.CO	Oestjydsk Bank A/S	Model 1
OLBG.F	Oldenburgische Landesbank AG	Model 1
OTPB.BU	OTP Bank Nyrt	Model 3
IL0A.I	Permanent TSB Group Holdings PLC	Model 1
BOPr.AT	Piraeus Bank SA	Model 1
PKO.WA	Powszechna Kasa Oszczednosci Bank Polski SA	Model 3
PBZ.ZA	Privredna Banka Zagreb dd	Model 1
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BAVL.PFT	Raiffeisen Bank Aval' PAT	Model 1
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RILBA.CO	Ringkjoebing Landbobank A/S	Model 1
ROSB.MM	Rosbank PAO	Model 1
RBS.L	Royal Bank of Scotland Group PLC	Model 1
SADG.OL	Sandnes Sparebank	Model 1
SBER.MM	Sberbank Rossii PAO	Model 2
SNBN.S	Schweizerische Nationalbank	Model 3
SAB1L.VL	Siauliu Bankas AB	Model 1
SEBa.ST	Skandinaviska Enskilda Banken AB	Model 3
SKJE.CO	Skjern Bank A/S	Model 1
SKUE.OL	Skue Sparebank	Model 3
SOGN.PA	Societe Generale SA	Model 1
SPNO.CO	Spar Nord Bank A/S	Model 1
NONG.OL	Sparebank 1 Nord-Norge	Model 3
MING.OL	Sparebank 1 SMN	Model 1
SRBANK.OL	Sparebank 1 SR Bank ASA	Model 3
SPMO.OL	Sparebanken More	Model 3
SPOG.OL	Sparebanken Ost	Model 3
SVEG.OL	Sparebanken Vest	Model 1
SGKN.S	St Galler Kantonalbank AG	Model 3
STAN.L	Standard Chartered PLC	Model 3
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SHBa.ST	Svenska Handelsbanken AB	Model 2
SWEDa.ST	Swedbank AB	Model 2
SYDB.CO	Sydbank A/S	Model 3
AMBr.AT	T Bank SA	Model 3
TOTA.CO	Totalbanken A/S	Model 1
TOTG.OL	Totens Sparebank	Model 1
GPSr.AT	TT Hellenic Postbank SA	Model 1
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VJBA.CO	Vestjysk Bank A/S	Model 1
VZRZ.MM	Vozrozhdenie Bank	Model 3

VPBN.S	VP Bank AG	Model 3
1VUB02AE.BV	Vseobecna Uverova Banka as	Model 1
WPBI.VI	Wiener Privatbank SE	Model 2
ZBB.ZA	Zagrebacka Banka dd	Model 1
ZG.S	Zuger Kantonalbank	Model 1

Appendix 3 – Univariate analysis

OLS univariate regressions of AR and CARs with all independent variables excluding business models

Univariate Analysis

	30/03/2009			17/12/2009			16/07/2010		
	AR [0]	CAR [-3,+3]	CAR [-1,+1]	AR [0]	CAR [-3,+3]	CAR [-1,+1]	AR [0]	CAR [-3,+3]	CAR [-1,+1]
Mkt Cap	-0,0580***	0,01655	-0,0445**	0,00037	-0,0439*	-0,0125	-0,0169**	-0,0202	-0,0255
	(3,17866)	(7,37179)	(4,66365)	(2,01897)	(5,34417)	(2,95420)	(1,71265)	(5,02366)	(5,40666)
R Sq.	0,08410	0,00138	0,02448	0,00000	0,01831	0,00491	0,02371	0,00398	0,00547
Ret As-sets	-0,0056	-0,7233	0,02351	0,05002	0,70882*	0,13905	-0,2116**	0,27442	-0,3432
	(3,32139)	(7,33206)	(4,72173)	(2,01820)	(5,33474)	(2,95738)	(1,70672)	(5,01840)	(5,39928)
R Sq.	0,00000	0,01212	0,00003	0,00077	0,02177	0,00277	0,03045	0,00606	0,00818
Ret Equi-ty	0,02007	-0,0660	0,00534	-0,0032	0,07312**	0,02212	-0,0416***	-0,0279	-0,0771***
	(3,31367)	(7,33924)	(4,72142)	(2,01864)	(5,33035)	(2,95096)	(1,60421)	(5,01430)	(5,28339)
R Sq.	0,00464	0,01018	0,00016	0,00033	0,02338	0,00709	0,14342	0,00769	0,05030
E/A	0,17191	2,51981	6,94180	-0,1411	16,6777***	0,23249	-1,4048	1,48215	-3,5878
	(3,32138)	(7,37467)	(4,69517)	(2,01895)	(5,25785)	(2,96145)	(1,73101)	(5,03281)	(5,41669)
R Sq.	0,00001	0,00060	0,01125	0,00002	0,04976	0,00003	0,00267	0,00035	0,00178

Standard error in parenthesis. * p<0.10; ** p<0.05; *** p< 0.01

Univariate

	26/07/2010			12/09/2010			16/12/2010		
	AR [0]	CAR [-3,+3]	CAR [-1,+1]	AR [0]	CAR [-3,+3]	CAR [-1,+1]	AR [0]	CAR [-3,+3]	CAR [-1,+1]
Mkt Cap	0,01510	0,04671*	0,04529**	0,01688*	0,02118	0,02698*	-0,0171**	-0,0472**	-0,0219*
	(2,11172)	(5,22459)	(4,10093)	(2,00935)	(4,08112)	(2,85447)	(1,43043)	(4,06379)	(2,39741)
R Sq.	0,01249	0,01939	0,02929	0,01716	0,00662	0,02162	0,03436	0,03236	0,02038
Ret As-sets	-0,1554	-0,0539	-0,4448*	0,01747	0,24434	0,26849*	-0,1879**	0,18675	0,00957
	(2,11339)	(5,27543)	(4,11351)	(2,02667)	(4,07978)	(2,86022)	(1,43066)	(4,12256)	(2,42219)
R Sq.	0,01093	0,00021	0,02332	0,00015	0,00727	0,01767	0,03405	0,00417	0,00003
Ret Equi-ty	-0,0227**	-0,0228	-0,0410**	0,00644	0,05475***	0,03038**	-0,0292***	0,05760***	0,00283
	(2,09448)	(5,26368)	(4,11167)	(2,02427)	(4,00264)	(2,84579)	(1,38086)	(4,03011)	(2,42182)
R Sq.	0,02855	0,00466	0,02419	0,00251	0,04445	0,02757	0,10012	0,04833	0,00034
Eq/ Asse	-5,1482**	-12,675**	-13,627***	-8,3742***	0,00306	-2,1126	1,15914	8,09864	1,73270
	(2,09953)	(5,21373)	(4,07065)	(1,95523)	(4,09470)	(2,88270)	(1,45378)	(4,09880)	(2,41971)
R Sq.	0,02386	0,02346	0,04357	0,06939	0,00000	0,00217	0,00257	0,01562	0,00208

Standard error in parenthesis. * p<0.10; ** p<0.05; *** p< 0.01

Appendix 4 - Descriptive statistics ARs and CARs

Descriptive statistics 30 Mar 2009

AR[0] 30 Mar 2009		CAR [-3,+3] 30 Mar 2009		CAR [-1,+1] 30 Mar 2009	
Mean	-1.13307	Mean	3.291625	Mean	-0.79293
Standard error	0.257781	Standard error	0.572539	Standard error	0.36647
Median	-0.31131	Median	1.5945	Median	-0.37149
SD	3.311262	SD	7.354392	SD	4.707394
Variance	10.96446	Variance	54.08708	Variance	22.15956
Min	-11.12	Min	-10.9726	Min	-14.4091
Max	5.893465	Max	34.48997	Max	12.33191

Descriptive statistics 17 Dec 2009

AR [0] 17 Dec 2009		CAR [-3,+3] 17 Dec 2009		CAR [-1,+1] 17 Dec 2009	
Mean	-0.00838	Mean	-3.04696	Mean	-0.72739
Standard error	0.156698	Standard error	0.418624	Standard error	0.229849
Median	-0.19122	Median	-2.21031	Median	-0.51594
SD	2.01282	SD	5.37732	SD	2.952459
Variance	4.051444	Variance	28.91557	Variance	8.717015
Min	-5.40446	Min	-33.1704	Min	-8.79726
Max	9.909187	Max	15.14467	Max	10.48481

Descriptive statistics 16 Jul 2010

AR[0] 16 Jul 2010		CAR [-3,+3] 16 Jul 2010		CAR [-1,+1] 16 Jul 2010	
Mean	0.917676	Mean	1.054987	Mean	2.277253
Standard error	0.134527	Standard error	0.390677	Standard error	0.420776
Median	0.462798	Median	-0.03525	Median	1.012266
SD	1.728035	SD	5.018334	SD	5.404971
Variance	2.986106	Variance	25.18367	Variance	29.21372
Min	-2.74833	Min	-5.55023	Min	-4.28132
Max	8.730092	Max	30.39217	Max	35.25316

Descriptive statistics 26 Jul 2010

AR[0] 26 Jul 2010		CAR [-3,+3] 26 Jul 2010		CAR [-1,+1] 26 Jul 2010	
Mean	0.754727	Mean	1.950916	Mean	1.813116
Standard error	0.164929	Standard error	0.409482	Standard error	0.323049
Median	0.321486	Median	0.837125	Median	0.836292
SD	2.118556	SD	5.259891	SD	4.14964
Variance	4.488278	Variance	27.66645	Variance	17.21951
Min	-3.63827	Min	-17.3194	Min	-6.59966
Max	16.38248	Max	25.49847	Max	22.56264

Descriptive statistics 12 Sep 2010

AR[0] 12 Sep 2010		CAR [-3,+3] 12 Sep 2010		CAR [-1,+1] 12 Sep 2010	
Mean	0.486577	Mean	0.153834	Mean	0.195749
Standard error	0.157306	Standard error	0.317799	Standard error	0.223977
Median	0.259178	Median	0.144407	Median	0.283755
SD	2.020637	SD	4.082197	SD	2.877042
Variance	4.082973	Variance	16.66433	Variance	8.277369
Min	-7.12629	Min	-18.0075	Min	-16.328
Max	8.98977	Max	17.04879	Max	8.577618

Descriptive statistics 16 Dec 2010

AR[0] 16 Dec 2010		CAR[-3,+3] 16 Dec 2010		CAR[-1,+1] 16 Dec 2010	
Mean	0.019278	Mean	-1.63564	Mean	-0.68141
Standard error	0.112977	Standard error	0.320631	Standard error	0.187995
Median	0.030427	Median	-0.80238	Median	-0.47956
SD	1.451218	SD	4.118585	SD	2.414841
Variance	2.106033	Variance	16.96274	Variance	5.831459
Min	-5.32767	Min	-18.5344	Min	-8.153
Max	7.451986	Max	10.46149	Max	6.559895

Descriptive statistics ROE and ROA by business model in 2010. Values are in %

	Model 1			Model 2	
	ROA	**ROE**		**ROA**	**ROE**
Mean	0,6934	5,2261	**Mean**	0,2707	5,1027
Standard error	0,1149	1,8046	**Standard error**	0,2166	2,7166
Median	0,6125	7,3680	**Median**	0,3751	8,4788
SD	1,1437	17,9560	**SD**	1,0387	13,0286
Variance	1,3081	322,4162	**Variance**	1,0789	169,7442
Min	-6,3605	-141,4532	**Min**	-3,4749	-43,2363
Max	4,8540	22,2568	**Max**	2,1090	30,5260

	Model 3			Model 4	
	ROA	**ROE**		**ROA**	**ROE**
Mean	0,2136	6,5662	**Mean**	4,6910	17,7799
Standard error	0,2444	1,5084	**Standard error**	2,3415	9,3019
Median	0,4443	6,9297	**Median**	4,3604	15,1266
SD	1,4863	9,1752	**SD**	3,3114	13,1549
Variance	2,2092	84,1836	**Variance**	10,9651	173,0514
Min	-7,9594	-34,8602	**Min**	0,8109	3,1598
Max	1,3186	23,5017	**Max**	8,9018	35,0532

Appendix 5 – Summary of statistically significant results in event study and in the regression model with business models

Events	Event study: statistically significant results	AR and CAR regression with business models: statistically significant results
Event 1	Window [0] • **Model 3 (T/NT):** -1.62%*	Window [0] • **Model 2 (NT/T):** -1.29% lower than Model 1 (T/T) Banks* • **Model 3 (T/NT):** -1.46% lower than Model 1 (T/T) banks** Window [-3,+3] • **Intercept: Model 1 (T/T)** expected to have 2.95% CAR*** • **Model 4 (NT/NT):** 9.28% more CAR than Model 1 (T/T) banks**
Event 2	Window [-3,+3] • **Total:** -3.25%* • **Model 1:** -3.96%*	Window [-3,+3] • **Intercept: Model 1 (T/T)** expected to have -3.63% CAR*** Window [-1,+1] • **Intercept: Model 1 (T/T)** expected to have -1.07% CAR** • **Model 2 (NT/T):** 1.42% above Model 1 (T/T) banks**
Event 3	Window [0] • **Total:** 0.86%* • **Model 1:** 1.07%** Window [-1,+1] • **Total:** 2.23%*** • **Model 1:** 2.39%** • **Model 2:** 2.03%* • **Model 3:** 1.73%*	Window [0] • **Intercept: Model 1 (T/T)** expected to have 1.09% CAR*** Window [-3,+3] • **Intercept: Model 1 (T/T)** expected to have 1.24% CAR** • **Model 4 (NT/NT):** 4.87% more CAR than Model 1 (T/T) banks* Window [-1,+1] • **Intercept: Model 1 (T/T)** expected to have 2.47% CAR***
Event 4	Window [0] • **Model 2:** 1.14%* Window [-1,+1] • **Total:** 1.81** • **Model 2:** 3.14%*** • **Model 3:** 2.10%**	Window [0] • **Intercept: Model 1 (T/T)** expected to have 0.67% CAR*** Window [-3,+3] • **Intercept: Model 1 (T/T)** expected to have 1.50% CAR*** Window [-1,+1] • **Intercept: Model 1 (T/T)** expected to have 1.31% CAR*** • **Model 2 (NT/T):** 2.33% above Model 1 (T/T) banks**
Event 5	Window [0] • **Model 3:** 1.24%**	Window [0] • **Model 3 (T/NT):** 1.73% above Model 1 (T/T) Banks*** Window [-1,+1] • **Model 3 (T/NT):** 1.20% above Model 1 (T/T) Banks**
Event 6	Window [-3,+3] • **Total:** -1.96* • **Model 2:** -3.39%**	Window [-1,+1] • **Intercept: Model 1 (T/T):** expected to have -0.54% CAR**