The Impact of Regulations on Banking Efficiency in the aftermath of the Financial Crisis of 2008

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Declaration: I, Amit Golchha, declare that this research is my original work and that it has never been presented to any institution or university for the award of Degree or Diploma. In addition, I have referenced correctly all literature and sources used in this work and this work is fully compliant with the Dublin Business School’s academic honesty policy.

Signed: Amit Golchha

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Abstract

This piece of work aims to quantify and draw conclusions by measuring the impact of regulatory rules individually in the post-crisis period versus the impact which earlier regulations had on banks in the pre-crisis period and in turn an ability to predict the impact of these variables of regulatory nature on the future of the banking industry in Europe. My analysis considers an 8 year time period of banks operating in the financial markets of the countries in European Union to determine the effect of changes in regulation rules on the efficiency of banks. To achieve this, I apply the Stochastic Frontier Analysis (SFA) model to estimate the profit and cost efficiency scores by combining the effects of regulatory determinants of efficiency and the impact they individually have on the overall efficiency of these banks.

Our results derive the main results that firstly, a high bank cost efficiency does not necessarily imply a high profit efficiency. Secondly, there was found to be a disadvantageous impact of the increase in market participants on the existing banks, the level of development of individual financial environments and the cost efficiency of non-domestic banks. Evidence was also found regarding the positive impact of rules that relate to the independence of the supervisory authority and coverage of private sector units that increase the transparency in the financial markets. also derived the negative effect of scope of business and diversification restrictions. However, the derivations regarding the financial crisis period often have shown us in the study the impact of different variables in an unexpected trend which relate to the part of time periods I consider in this study.
1. Introduction

1.1 Dissertation Roadmap

The dissertation study is outlined in the following components:
Section 1 (Introduction) provides a sweet introduction to the importance of regulations and the summaries of theories and literature existing in the financial markets about the interaction of regulations with a country’s overall financial markets and rise of parallel systems like shadow banking. Section 2 (Literature Review) summarises the existing literature related to the topic and concepts to be studied in this dissertation study by constructing themes that categorically cover most aspects related to the study. Section 3 (Research Methodology and Methods) will provide a theoretical background on the methodology I have decided to use in this study to derive the efficiency scores, giving a comparison of advantages and disadvantages of the method that I have selected and the next best methods which I had to give up. Section 4 (Data Analysis and Findings) This section introduces the process of data collection and methodology to be used. Also, in this section, econometric analysis of the data is carried out, hypotheses are tested and followed by presentation and discussion of results in section 5. In Section 6 (Conclusion) the main points of the thesis are reviewed and linked to the initial objectives at the commencement of this Dissertation study. Section 7 provides a reflective learning statement which encompasses all the learnings and reflections that I have made during the entire duration of this dissertation study, while the last section provides a list of references and further reading.

1.2 Theoretical Background:

A country’s overall economic growth, development and stability depends on the kind of financial system it builds and maintains. Crockett (2011) studied and noted that financial system of a country can be considered as its nervous system which helps in allocating resources efficiently across the entire geography and demography. The
time when financial institutions were just used for credit and payments is a thing of past and with the evolution of complex business activities in these institutions, the importance of such institutions in the entire system has become paramount. The success or failure of a firm’s operations will depend on the kind of reaction it visions to the change in regulatory rules applicable to it. This will also depend on the kind of resources the firm is able to derive and utilise in response to the regulatory changes (Ferraro and Gurses, 2009).

It is also implied that a change in the regulatory environment of a firm not only affects the firm as a single unit but indirectly affects the entire financial environment around it (Jaspers, Prencipe and Ende, 2012). There are different responses that are required from various divisions of a firm such as a different response from the technology management division and an altogether different response from the legal team, which when combined results in the overall response of the firm to the regulatory change (Pisano and Teece, 2007). Hence, to understand the impact of change of regulatory rules applicable to the firm, it is necessary to analyse the impact of the rules on various parts of the firm as they could possible affect consolidation efforts (Jacobides, 2005). Banks are considered to be at the epicentre of the Global Financial Crisis (GFC) crisis of 2008. Their business models and strategies were questioned and the existing regulatory systems bought to the table. In such a period of turmoil, a need for stronger regulations was inevitable. Whatever the purpose of these regulations, good, bad or both, it turns out that the banks have had an additional set of rules to cope up with. Rules which were not as pervasive as the pre-crisis period.

Therefore, the burden to regulate and promote the institutions lies on the country directly, especially when these institutions are a means for the governments to play with their monetary policies. A bank’s existence depends on a substantial extent to the kind of information it can collect, given the fact that the information would be costly (Bollard, et al., 2011). Much of the survival depends on their ability to do this continually and with the first mover advantage. As there is a high customer to bank ratio, banks perform business activities over huge volumes and are thus able to take care of the transaction costs. They are also able to magnify returns by writing debt
contracts with clients (Barth, et al, 2005). This play in volume enables banks to provide auxiliary services as mainstream business services, for example short term no deposit lending, financing illiquid assets like loans of mortgages and business lending. Therefore, banks are also called as drivers of risk.

Banks face a major task at hand in evaluating the creditworthiness of their clients. They are not able to guarantee is the client they are dealing with would not misbehave with their assets and in turn result in bad debts. With a prudent business plan in mind, these banks then take the decision of fixing interest rates according to the credit worthiness of their customer. They put in cheaper costs for clients with informed financials and higher rates for clients which are suspicious. (Barth et al., 2005, p.7) This enables the banks to increase their efficiency over time by minimising transaction costs and have sufficient database to evaluate their clients who repeat business with them. While on the other hand, the customer is also virtually stuck into the banking relation with his existing bank which makes it costlier for him to switch banks, because then his creditworthiness would be unknown to the new institution with whom he is looking to pair up with and it might possibly mean higher costs for him. This is called as information monopoly and privilege. (Ariccia, 1997).

1.3 What is intended to be achieved in the study?

The primary objective of this study is to derive the impact of regulatory changes in the form of different regulatory variables on the efficiency of the banks of countries that are a part of the European Union in the time period between 2005 to 2013. Efficiency in this study has been repeatedly stressed as efficiency is the most relevant indicator for our study that would fit in to answer our research questions while at the same time serving as an indicator of the impact of regulatory changes on the overall functioning of the banks. This would also help us possible drive a trend which may indicate the survival of banks in the future time periods. This period from 2005-2013 has been chosen as a relevant time frame which encompasses the build up to the crisis (boom cycle), the crisis years and the recovery period. The purpose behind choosing this time frame was to enable us to derive the comparative effects of the regulatory variables existing at the time of these three phases while
incorporating the major changes that were brought about newer and stricter rules as a response to the crisis in a quantitative study. This will enable us to support the major research questions:

- Have the regulations that were imposed on the banks post crisis affected the efficiency with which banks operate?
- Would this effect on the efficiency of banks have an impact on their survival in various geographies, competition versus the private sector and shadow banking entities?
- How would the bank’s cost and profit efficiency be affected with respect to the changes in the regulatory environment around them in specific time periods around the financial crisis.

To enable us have a better understanding and encompass uncertainties and volatility which exist in the financial markets, more so after the financial crisis, I would also extend our scope to include hypotheses that cover some of the major concerns around the main research question. These are:

- **Hypothesis 1**: There is a significant difference in the impact of regulatory instruments on the profit efficiency and cost efficiency as separate indicators.
- **Hypothesis 2**: The internationally based regulation policies and systems (such as Basel norms) have a positive impact on the bank’s efficiency.
- **Hypothesis 3**: The independence of the regulatory authority could have a positive impact on the efficiency.
- **Hypothesis 4**: The factors relating to the financial market discipline relate to a positive impact on the bank efficiency.
- **Hypothesis 5**: The impact of regulatory changes is significantly different when focus is given to the crisis years.

The motivation behind taking up this study is the complex nature of the regulatory space and its interaction with the banking efficiency which has not been significantly explored nor bought into the common understanding of the average investor. Our future holds a lot in store and with proper information and understanding at hand,
another crisis of such nature could be handled in a much more effective way so as not to burden the survival and existence of the bank itself. Also, the play of these variables which affect the efficiency of the banks and their interaction with the financial statements in different scenarios has to be given more light to because these factors when taken due care of, would automatically induce the stakeholders to take necessary corrective and preventive action. It becomes all the more relevant as I witness the internationalisation and unification of financial markets and change in the traditional characteristics that have been associated with the banking industry since long. Since I are the game changers going ahead, it is imperative for us to set up a broad outlet where studies like these can be accessed from which might someday form a logical base for a revolutionary decision making phenomenon. The game would obviously change from a wait, watch and then take corrective actions to something like act, react and prevent. This is the ideology which I am preparing myself for and this piece of study is the kickstarter a change in ideology.

1.4 Limitations of the study

While an effort has been made to make the study as comprehensive as possible, but due to the reasons of practicality, objectivity and constraints, there have been some limitations that I have identified related to this study.

- **Geography:** While it may be imperative to include the global geography to answer the research question broadly, for reasons of practicality and relevance I have decided to include only the European Union as the geography of my study. Hence, it would not be a logical choice to extend the results of this thesis beyond the EU.

- **Independent Variables:** I have given due care to include most of the major regulatory variables in my study that affect the banks significantly. However, the estimation of efficiency is also subject to the qualitative variables and effects beyond the explanation of theories and concepts that exist parallely such as lobbying etc. One way of limiting the limits of this study is to regulate shadow banking space as fairly as traditional banks are being regulated. Hence, the results
of this study are devoid of some of the qualitative aspects which are essential to the prediction of the outcome of success of banks.

• **Impact on Varied Indicators and further conclusions**: In this study, two concepts - Total Cost and Profit before Tax have been considered to derive the efficiency scores for banks. Hence, it may not be feasible to allocate the findings of this study when other variables such as marginal cost or profit after tax are considered.

• **Time frame of the study**: As the study has been based on historical data, an entirely accurate prediction of the future of banks is not possible as the future is uncertain and filled with volatility. It is also a combination of various changes in the environmental variables which cannot be included in the study, owning to the specifics that I have chosen.

• **Data accuracy**: While reliable sources have been used to form a base for our study, the possibility cannot be eliminated that there could have been some error or omission on the part of these sources while collecting the primary data. Our research is based on secondary data collected from these sources while placing the assumption of correctness and accuracy of this data. This, if true, could deviate our results based on the inputs which are affected.

• **Methodology and models used**: The nature of this study is quantitative and mathematical and financial models used in this study are not devoid of any limitations (Creswell, 2009). Hence, deriving conclusions purely based on the numerical and statistical data might be risky.

### 1.5 Major contributions of the study:

This study is aimed not only to help me achieve my dissertation objectives, but also help the components of this study and major groups that are involved in the operation of the financial markets take due note of the issues at hand, evolution of
the changes in the banking sphere and the actions to be taken to maintain stability and efficiency in the banking world.

• **Inspiration for Bank Managers and Owners:** This study richly investigates the impact of various regulatory variables of the financial indicators of the banks. These results and processes which are used in the study may serve as a relevant self-analysis and strategy formulation tool for managers as they would become aware of the implications of changes of regulatory variables on their financial results.

• **Inspiration for Supervisory Authorities:** When the findings of the data are studied keeping the entire economic scenario at the crisis period in mind, it might help the Authorities further realise the importance they have and are expected out of on a continual basis. The lessons learnt form the pre financial crises is that the crises have always been a result of the gaps that have been. Existing in the regulatory space and were exploited by some interested parties which ultimately was termed as a failure on the part of the regulators. It will also inspire authorities to enhance their competitiveness and bring in more complicated and shadow sectors of the financial world into the purview of efficient regulation. This would also enable the supervisors to have a sense of where regulations are being excessive in a way that they have been unfair to the survival and efficiency of banks indirectly hurting the financial markets in the end. This can be summarised as inducing optimum supervision.

• **Inspiration for the Academic and Professional Community:** The nature of the study encompasses a comparison between three time periods to provide a relevant impact of changes happening in the regulatory space. This might serve as an inspiration to the academicians to indulge in relevant studies that have a deeper impact on the functioning of the financial markets rather than just base the studies in a shallow literature pool. Also for professionals belonging to this field, it will help them understand the action space in the financial world and look for opportunities and specialised knowledge in this space which will help them shape up their careers and professional relevance.
2. Literature Review

The purpose of this quantitative study is to derive if a lack of regulations resulted in an increase in efficiency of banks and if more regulations resulted in a decrease in efficiency in pre and post crisis period respectively.

As studied by Binder (2013), banks are traditionally regulated to limit the damage if a single bank collapses, prevent the fall of a country’s financial structure and reduce the cost borne by its taxpaying citizens. A similar view was expressed by Gerding (2011) who went out to state the banking was not as exciting a business after the Great Depression. He contended that customers were secured even if the excessive regulations burdened the banking system at the time. Lutrel et al., 2012 argued against excessive regulations that they limited competition between banks. Kuotsai Liou (2013) in the “Financial Crisis and the Challenge of Government Regulation” identified four components that can lead to a threat of crisis: unethical behaviour, weakness of financial corporations, effects of systemic risk and government policy failure. This led to the creation of Acts like the Dodd Frank Act which in turn led to the creation of the Financial Stability Oversight Council. But this comes at a cost to the banks, as a survey by RIMES of shows that 86% of the banks expect that such regulations as the Dodd Frank will significantly lead to an increase in the cost of their operations. (RIMES Survey, 2013)

Robert Nowak, explains that excessive risk taking with the lack of necessary regulations harms the economy. (Nowak, 2011). He argued that businesses become less concerned about the safety of the public when weaker regulations allow them to enhance their profits and march ahead of the competition. Whereas with regulation the safety of consumer is a priority and the health of the general public and environment are protected which leads to greater economic stability. (Seabury, 2008).

Also, the effectiveness of financial market regulations depend upon the kind of people that are involved in the setting up and implementation of the rules. Hence when the human aspect of anything comes into play, it cannot be assured that it will
do more good than harm. Administrative skills, personal motives and transparency are some factors that adds credit to researchers who believe that regulation actually does more harm than good. (Liou, 2013).

2.1 Literature on Capital Adequacy Restrictions:

**Little Impact:** Capital acts as a buffer against probable losses thus diminishing the possibility of a financial failure by acting as a regulatory instrument (Chortareas et al. 2010). The study also examined the possibility if these capital requirements acted as a possible hinderance to the risk taking initiatives of banks. His study comprising bank regulation data from the World Bank Database of Regulation and Supervision from 2004-2011 for about 107 countries has found little relation to the impact of capital restrictions on the growth and profitability margins of banks. However the underlying assumptions in this framework was primarily based on the fact that the supervision power of the legislatures is weak and that they do not penetrative in the complex nature of businesses carried on by these banks. Contrastingly, banks were found to have been negatively correlated to stringency of capital regulation in the same time period.

**Positive impact:** In the study of Barth et al. (2013), positive effect of stronger capital restrictions were derived about a bank’s efficiency in the pre-crisis period, using World Bank supervision data for EU countries from the period 2000-2008. In a study by Kim et al. (2013) who used financial and macroeconomic data for 132 countries in two years post crisis (2007-09), discovered solid positive impact of regulations being able to suppress the likelihood of financial crises.

**Negative Impact:** The study of Barth et al. (2013) though derive that restrictions of capital suppress likelihood of financial crises, at the same time also conclude that strong capital rules have a counterproductive effect on a bank’s efficiency and stability. This has also been confirmed in a study by. Lee at al. (2013) in China a different geography than EU, which show little positive influence of adequacy ratio requirements. However, these studies were primarily based on the assumptions that
capital requirement measures are dependent on broader financial framework and the size of a financial entity.

**Mixed Impact:** A study by Pasiouras et al. (2009) using data provided in BankScope for 600 banks during the four years from 2004 derived opposite effects of capital necessities to be maintained at the banks in accordance with the two pillars of the Basel norms. This study also concluded that there was a favourable impact on cost efficiency but an unfavourable one on the profit efficiency. The drawback of this study is the assumption that stringent regulatory policies by themselves encourage banks to give up expensive risk management operations which is impractical in a risk-based business. Appelbaum and Dennis in 2009 studied and derived that while increased capital requirements make a bank safer, if the regulations become too tight, they might prevent banks from lending in the event of an economic crisis. This would lead to a decline in the jobs and growth opportunities of banks and also a reduction in fraud and other measures (Bearman, 2011).

### 2.2 Literature on Scope of Business Activities restrictions:

**Positive Impact on the market:** A study by Crockett (2011) argues that there should be a limit on the scope and nature of business activities which banks undertake as higher risk-based businesses. This creates pressure on moral hazard and discourages banks to undertake risky business activities. He also derived that these restrictions act as a tool to avoid these banks turning out to become such large and complex structures that would eventually make them difficult or even impossible to monitor. He labelled them as ‘too big to discipline’ entities.

**Negative Impact on the bank:** Negative impact of tightening of business scope restrictions have been highlighted in a study by Chortareas (2010), where he suggested that as banks are prevented from engaging in risk diversification activities, they suffer on account of lower performance and efficiency. He also implied that there also exist possible trade-offs between the restrictions and banks soundness ratios.
2.3 Literature on Entry into Banking and Foreign Ownership Regulations:

It is widely known that entry to banking sector is more of a bureaucratic matter in some countries than a level playing field for all. As studied by Case and Girardone (2012), a level playing field was the main objective of the regulations that started to come in after 2008. This was also done with the objective of consolidation in mind of the regulators based in the European Union considering the effects on dual banking in this geography. They also concluded that while ease of entry rules led to an increase in the concentration of banks across Europe, deregulation led to an increase in the consolidation phenomenon due to the unequal efficiencies enjoy by the players in the market. They concluded that “the relationship between competition and efficiency is not a straightforward one: increased competition has forced banks to become more efficient but increased efficiency is not resulting in more competitive EU banking systems.”

It was also derived in study of Moschella and Tsingou (2013) that regulations which have been formulated at the international level are often a minor tweak to the existing rules which do not serve a paradigm shift even in cases like the post crisis period. He further went on to state that the newer regulations have fallen short of the expectations and instead can just be labelled as minor tweaks and incremental changes.

2.4. Literature on Private Monitoring and Market Discipline

There appears to be a common consensus in the thoughts of academicians based in USA, Britain and even in continental Europe that when there are regulations created that demand more compliances from the private sector, it leads to an overall efficiency of the financial markets in that geography. Delis, Molyneux and Pasiouras (2009) concluded that there is a widespread requirement by international
organisations and associations that with respect to Basel norms, productivity and efficiency, private sector monitoring needs to be stepped up to implement a stricter framework even if there is no one standard framework that fits in the regulatory requirements of individual countries. Porter (2005) has even an interesting outcome in his study where he has stated that the private players have been tactically able to avoid the on-boarding of regulations by creating a private standard setting mechanism that virtually gives the sense of the private sector being regulated fairly. He also highlights how the international supervisory community has been able to ward off its responsibilities by delegating the responsibility of regulation to a few large auditing and credit ratings firms which themselves are not subject to any transparency requirements.

Volumes of literature exists that the private monitoring adds to the improvement of bank efficiency while only limited evidence exists that suggests that private monitoring actually improves financial intermediation (Delis et al. 2011). A few scholars have also studied the regulatory response to the demand to expand the jurisdiction of the official supervision powers to the newly growing avenues (that had been left out of the purview of regulation) at the time of the crisis like hedge funds, derivatives and shadow banking. (Quaglia, 2017).

2.5 Literature on Official Supervision Powers:

**Negative Influence:** Pasiouras (2013) used a sample of 4000 banks operating between 2002-08 in over 80 countries to derive the results that as more sectors of the financial hemisphere are bought into financial supervision by a single supervisor, it leads to a decrease in the bank’s efficiency. He studied the impact of having individual specialised regulators for each sector and nature of activities and derived that banks perform efficiently when there are specialised regulators which avoids the burden of complying with irrelevant regulations as might by imposed by a single supervisor across the financial environment as a standard, which might not fit into the business activities of all types of entities operating in such an environment. Drezner (2014) mentions that even after fierce resistance from the international banking community, BCBS regulators could revise the Basel agreement (Basel III) in
only two odd years as compared to the 6 years it took them to renegotiate the erroneous Basel II norms. Wilf (2016) even supports the fact with evidences in his study that shareholders found Basel III norms as a significant constraint that might drive down the bottomline.

**Positive Influence:** Caganis (2013) on the other hand concluded that having independent supervisory authority is statistically positively related to a bank’s efficiency, although an increase in the strength of the supervisory authority might not by itself lead to an increase in the efficiency of banks as well. However, an increase in the independence of the regulatory authority might lead to an increase in the bank’s overall efficiency. Baker (2013) also highlighted the change in approach of regulators from a largely self regulated approach to a more imposing and demanding regulatory framework.

Ongena and Udell (2013) have derived the effects that state that regulatory arbitrage existed prominently with data up to 2008. Also a more recent study by Fratzcher (2015) indicates that the phenomenon of regulatory arbitrage still exists in recent years and intact drives operational efficiency for some influential banks.

### 2.6 Literature on Shadow banking system:

Gennaioli, Shleifer and Vishny (2013) defined shadow banking as a collection of financial transactions that happen outside the regulated space. Adrian and Ashcraft (2012) also described shadow banking as a mutation of several financial institutions that move funds from savers to depositors. They also noted that shadow banking reforms the same credit transformation function as a traditional bank but doesn’t quite enjoy the population support which traditional banks enjoy. Pozsar et. Al (2010) described shadow banking as a collection of financial intermediaries who provide credit intermediation functions - including Maturity Transformation, Credit Transformation and Liquidity Transformation. Gerding (2011) tried to distinguish shadow banking system from the traditional system on the following six features:
• Pooling of financial assets and risks
• Packaging and repackaging cash flows from financial assets
• Engaging in maturity transformations
• Creating assets with high liquidity and low risk almost as good features as money
• Opaque operating system due to regulations out of scope

The Financial Stability Board (FSB), which is the penultimate office which defines financial terms, has described in 2012 Shadow Banking as Credit or Financial Intermediation happening outside the regulated financial sector. This definition thus included brokers, investment banks etc. and also encompassed financial instruments such as asset backed securities and mortgage backed securities.

Some scholars described the shadow banking system as a system where simple retail funded deposits generate wholesale-funded held to maturity lending.

Using the strategy of leveraging, the shadow banking system could generate more short term profits by allocating are capital towards the securitised asset class (Admati and Hellwig, 2013). The shadow banking system can generate its own risky and risk free loans and it can also fund its own assets using these loans or issuing commercial debt. (Gennaioli, Shleifer and Vishny, 2013). This can be understood as funding substitutes for retail deposits used in the regulated banking sector. This can help contribute to profits in an economic boom and also make banks vulnerable during bust times.

Most of the existing literature focuses on the nomenclature of shadow banking and how it came into existence. Also, many scholars like Luttrell, Rosenblum and Thies in their study in 2012 focussed their study on the role of credit intermediation by traditional banks and the impact it has on the traditional banking system. They mentioned that traditional banks fuel economic growth through a single balance sheet structure whereas shadow banking system performs the same function through multiple balance sheets.
The existing literature on shadow banking did not mention any solid reasons on why the entire system of shadow banking came into picture. It was more recent literature that tried to identify explanations for the existence of the shadow banking system such as (a) innovation in the way how aggregate monetary supply works, (b) taxes and arbitrage opportunities and (c) agency problems in existing financial markets (Adrian and Ashcraft, 2012). Some scholars improvised on the explanation of the operation of shadow banking by attributing two more features: competition, arbitrage, accounting makeovers, completion in innovation of financial technology, taxes and agency problems (Admanti and Hellwig, 2013).

Gerding (2011) while agreeing with the study by Luttrell, Rosenblum and Thies, added that shadow banking is able to connect households and investors apart from the usual borrower-investor pair. This makes shadow banking a hybrid system which performs the role of a traditional bank as well as harnessing the needs of those beyond the reach of traditional banking system.

Gerdin (2011) described that shadow banking by its nature needs a special and different form regulatory supervision as compared to traditional banks. It is mutilated in their nature of business that imposing same regulatory rules over traditional banking and shadow banking system alike would be unfair to both sides.

2.7 Literature on Responses of Banks to Regulations

The actions taken by firms in response to regulations will affect their operations. A beginning point of to understand the complex needs of the regulations is to understand that regulations are an external factor to the firm (Ferraro and Gurses, 2009). Firms can be proactive at the initial stages itself and support or oppose the regulations that are being proposed (Pisano and Teece, 2007). Current research talk less frequently about how firms accept and embrace newer regulations. The firms might sometimes seek to favourable influence the regulators or sometimes even develop a new product that altogether bypasses the applicability of these regulatory rules to that product (Funk and Hirschman, 2014). Sometimes these regulations can be considered to be an assault by regulators on the banks (“Citi Says”, 2015) and
poses newer headwinds to the banks. Some banks even continue evasive practices by avoiding the applicability of rules altogether to their firms through the channels of shadow banking and off balance sheet dealings.

On the other hand there comes into picture the first mover advantage concept as well. Often it is seen that firms which embrace and accept regulations much earlier than firms who adopt them later are in a better position to take care of their operations and business environment in the short and medium run and hence are more likely to succeed. (Smith and Grimm, 1987). Firms that are active in understanding the regulatory perspective and design suitable response vehicles to these regulations are more likely to fend off competition that firms who don’t.

2.8 Literature on Technological Inclusion and Foreign Ownership Variables

The importance of technological change has been stressed in the study of Kumar, Charles and Mishra (2016) where they related an increase in the total factor productivity to an increase in the technological changes adopted by the banks. But the drawback of this study was that the geography was limited to only India which is a developing country and is characterised by an excess supply of input factors like cheap labour and raw material which do not adequately justify the impact of technological change on the bank’s efficiency. In the study by Aysan and Ceyhan (2008) on the Turkish banking sector, they concluded that the number of bank branches of a bank has a negative effect on the efficiency of a bank but bank capitalisation and loan ratios had a positive effect on the efficiency while foreign ownership was insignificant. They also suggested that restructuring attempts post crisis improved efficiency of the Turkish banks.

There is a good amount of literature that focusses on the effects of foreign ownership of banks in different geographies. These banks usually have the resources and technical capabilities superior to that of the destination country and in turn could benefit the host country in the form of better management skills, efficiency, jobs creation and newer technologies. (Luo et al. 2015). An opposite view also is expressed in the study of Heinz (2014) where she cautioned that banks might suffer
from additional burden of cost and misinformation scales, while at the same time hurting the local businesses by skimming up the cream section of clientele.

### 2.9 Need for additional literature

In a nutshell, it can be summed up from the above literature that most scholars and academicians conclude that bank regulations and supervisions do have an impact on the efficiency and risk taking of the banks. Most of this literature calls for deregulation and calling for self regulation by banks and groups. This is also to be noted that these scholars come from countries where the financial and legal infrastructure is considered to be at an advanced level and their beliefs in the free market system are varied. It is also suggested in their literature that excess regulations would in some way lead to a decline in efficiency as excess compliances would result in additional costs for these banks and divert its attention from its core businesses to meeting compliances.

There also exist supervisory systems which come with inbuilt restrictions primarily because of the nature of their set up and the environment around them. For example, a restrictive banking system would lead to an improper development of the financial system of the country. Another limitation of the literature that has been put up post the financial crisis is that their results usually consider a single reform and the impact that single variable has along with a comparison of a few other variables as well. Hence, there are vast chances that different conclusions could be reached when considering various reforms in their own domain. (Kastner, 2014)

Thus it can be seen from the above there exists no single study which tries to assess the impact of regulations in the pre crisis and post crisis period while considering the impact of various variables that impact the efficiency of the operations of these banks when they interact amongst themselves and also the effect they have when they act alone. This study will try to achieve exactly this objective.
3. Research Methodology and Methods

The objective of this section is to introduce the methodology to be used in this thesis for the estimation of the efficiency which will later be used in the empirical analysis section of the thesis as well. I will also mention the models to be used in the estimation of a bank’s profit and cost efficiency in context of the regulations in the financial markets. I will provide a brief introduction to the most suitable methods to be used for efficiency analysis in the context of this thesis. This will include a short description about Stochastic Frontier Analysis (SFA) and the theory on the Data Envelopment Analysis (DEA). The selection of both these methods has been considered appropriate after considering the underlying assumptions and limitations relating to the parameters of this thesis. I will also provide a comparative analysis between the methods mentioning the advantages and disadvantages so as to derive which method would be most suitable for the purposes of this study.

Debreu (1951) and Farrell (1957) developed the first methodology on analysis of efficiency scores and production and cost function. Farrell (1957) suggested that an entity’s efficiency can be driven based on its current production conditions. The most striking part of his methodology was the assumption that imperfect decisions exist in the operations of the firm and that input-output misallocations result as a result of these imperfect decisions. Farrell (1957) also introduced two main components of efficiency scores: Technical efficiency and Allocation efficiency which together form the overall score of the Decision Making Unit (DMU). Technical efficiency relates to the ability of a firm to minimise in inputs while generating maximum output, whereas Allocation efficiency judges the DMU’s ability to use resources as inputs in optimal proportions after considering their pricing and production technology. (Coelli, et al., 1997).

There have been multiple approaches introduced the financial markets for the evaluation of efficiency scores. These can be divided into multiple categories going forward based on the nature of assumptions and techniques used to determine the
efficiency scores and also on the occurrence of random errors and care to deal with the impact on production which these errors create:

A. **Parametric Approach:** These are based on the strictest categorisation of the functional forms used by the DMUs and the deviations from it which result in the inefficiencies.

B. **Non Parametric Approach:** Opposite to the parametric approach, these methods do not depend on the functional form of the best practice frontier or distribution aspects of the inefficiencies.

C. **Deterministic Approach:** In these methods, the determination of the inefficiency of the DMU’s lies on the levels between the DMUs observed production inefficiency scales while comparing it to an efficient reference on the frontier (Fiorentino, et al., 2006).

While relating these methods to the thesis and the determination of the efficiency scores of banks, their production process can be described as a function of multiple inputs and also considering the variables which have a significant trauma on the process. In the banking sector in recent years, any methods have been adopted based on theoretical studies. The most relevant and utilised methods in recent years are Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA).

### 3.1 Stochastic Frontier Analysis (SFA):

Designed by Aigner et al. (1997), Battese and Corra (1977), Meeusen (1997) and Van den Broek (1997), the Stochastic Frontier Analysis determines the efficiency stochastic production frontier. After considering the assumptions about the distribution of variable that influence the efficiency, the SFA breaks up the residuals as noise and inefficiency.

The most significant assumption of this SFA model is the knowledge and handiness of data of the production function of the most efficient DMU production function, from which the deviations of the real production function of a DMU can be measured. Microeconomic theories put in a primary fact that firms face the basic challenge of
optimising production with the ultimate aim to optimise the output vector $Q_{it}$ (which can also be called cost minimisation or profit maximisation) with the available input matrix $X_{it}$. Thus the process can be read as a function of input prices $w_{it}$, output quantity $y_{it}$ and other variables influencing the problem whether internal or external. To determine the aspects leading to inefficiency term of the production of DMU, I also have to take into consideration related variables, circumstances that affect the production and also random shocks that create a negative effect.

Hence, the function can be derived as follows:

$$Q_{it} = f(X_{it}, \beta) \xi_{it} \exp(v_{it})$$ (1)

Where the term $\xi_{it} \exp(v_{it})$ denotes the inefficiency - a product of random shocks $\exp(v_{it})$ and technical inefficiency $\xi_{it}$ relating to production, where the absolute value of $\xi_{it}$ lies between the range $(0,1)$. A technical efficiency of 1, cited as $\xi_{it}=1$ denotes that the firm is at the best possible state for production which can be set as a benchmark. Technical efficiency score of less than 1 signifies that the firm can still set out to maximise its output $Q_{it}$ with the help of technology. Since the output has to be positive or $Q_{it} > 0$, the technical efficiency $\xi_{it}$ is also assumed to be greater than zero as well. It can generally be described in the logarithmic form as:

$$Y_{it} = X_{it} \beta + (V_{it} - U_{it}) \text{ for } i=1,...,N, t=1,...,T$$ (2)

Where $Y_{it}$ denotes the logarithm of the production output $Q_{it}$ of the $i$-th firm in the $t$-th time period, $X_{it}$ denotes the $(k \times 1)$ input matrix for the firm $i$, $\beta$ is a vector whose parameter remains unknown, $V_{it}$ denotes random error (including the effects of unpredictable factors and variables), with $V_{i} \sim N(0,\sigma v^2)$ and also independent of the variables with a definite value or justification. The term $U_{i}$ ($U_{i} = \log(\xi_{it})$) is the positive external variables which also have an impact on the inefficiency of the production while assuming iid, $U_{i} \sim N((0, \sigma u^2)$ independent of $V_{i}$.
Fiorentino, et al. 2006). The stochastic isoquant defining the upper limit is described by the term $\xi$. $$Q_{it} = \exp\left(\sum_{n=0}^{N} \beta_n \ln X_{nit}\right) \cdot \exp(p(v_{it}) \cdot \exp(-u_{it}) \right).$$ (3)

The deterministic part of the frontier model governs the estimation of the stochastic frontier model and is defined by the expression - $\exp\left(\sum_{n=0}^{N} \beta_n \ln X_{nit}\right)$. The significance of the deterministic component of the equation is vital as random error can assume any value which can be positive or negative. Hence, it is of utmost importance to specify the functional form to estimate the stochastic frontier model. As banking is characterised my multiple inputs and outputs, it is difficult and sometimes impossible to define the functional form for the banking firm distinctly. I am also aware about cost minimisation behaviour of banks, which forms a part of behavioural assumptions in our analysis.

In the recent past years, Cobb- Douglas function has been considered as a standard production function to estimate the efficiency scores. There has also been an increase in the freedom to consider more independent modifications of the production function with the objective to make the production function more comprehensive. Relating this to the banking sector, I have found two modifications that suit our analysis of the efficiency of the banking sector. The first modification, transcendental logarithmic (translog) function proposed by Berndt and Christensen (1973), is a general and less restrictive form of production function. It is widely recognised and used to measure efficiency. The second modification, Fourier-flexible functional form has been regarded by many as the most relevant function to predict the efficiency of the banking sector.

**Specification of the Transcendental (Translog) Model:**

Considered to be a generalised form of the Cobb-Douglas production function, the translog model describes the combination of input and other outputs in a non-linear form. Due to its nature of being more flexible on the aspects of production elasticity
and substitution elasticity, it is considered more relevant in our study. At the same time while being flexible, it can also enable us to impose any restriction on any parameter which seems irrelevant. It can be formulated as:

$$Q_{it} = \exp(\beta_0 + \sum_{n=1}^{N} \beta_n \ln x_{nit} + \frac{1}{2} \sum_{n=1}^{N} \sum_{m=1}^{M} \beta_{nm} \ln x_{nit} \ln x_{mit}) + v_{it} + u_{it} \quad (4),$$

While the translog fictional form has many advantages and relevance, it is also not devoid of any disadvantages. The major disadvantage of this method is its difficult interpretation, owing primarily to the complex statistical derivation using complex variables as inputs. Another issue at hand is that of multicollinearity in data, in which case the Cobb-Douglas function produces more relevant results.

The model for the cost production frontier using the translog functional form can be derived as:

$$\ln TC_{it} = \beta_0 + \sum_{n=1}^{N} \beta_n \ln(Q_{nit}) + \frac{1}{2} \sum_{n=1}^{N} \beta_n (\ln(Q_{nit}))^2 + \sum_{n=1}^{N} \sum_{s=1}^{S} \beta_{ns} \ln(Q_{nsit}) + \sum_{m=1}^{M} \beta_m \ln(P_{mit}) + \frac{1}{2} \sum_{m=1}^{M} (\ln(P_{mit}))^2 \sum_{m=1}^{M} \sum_{r=1}^{R} \beta_{mr} \ln(P_{mit}) \ln(P_{rit}) \quad + u_{it} + v_{it} \quad (5)$$

Where TC means Total Cost, Q denotes the vector of output quantity for i-th bank in the time period t and P describes the vector for input prices for the same bank in the same time period.

**Fourier Flexible Functional Form:**

In addition to the derivation of translog functional model, by adding Fourier’s trigonometric components, I can derive the Fourier Flexible Functional Form. The equation is as under:
\[\ln(\frac{TC}{p}) = \alpha + \sum_{n=1}^{n-1} \beta \ln(p) + \sum_{n} Q \ln Q + \sum_{n} \gamma \ln E + n i=11 k r=1 r r \]

\[1 \left[ \sum_{n=1}^{n-1} \sum_{i=1}^{n-1} \beta \ln(p) \right] + \sum_{n} Q \ln Q \ln Q + 2 i=1 j=1 i j k=1 m=1 k m k m \]

\[1 \left[ \sum_{n} \psi \ln E \ln E \right] + \sum_{n=1}^{n-1} \sum_{n} \delta (\ln(p)) \ln(Q) + 2 r=1 x=1 r s r s i=1 k=1 i k p_3 \]

\[k \]

\[\sum_{p=1}^{2} \sum_{r=1}^{3} \epsilon \ln(p) \ln(z) + \sum_{n} \sum_{r} \ln Q \ln E + \sum_{n=1}^{3(n-1)} \pi \cos(x) + i=1 r=1 i r \]

\[p_{n-1} r k=1 l=1 k r k r n=1 n n \]

\[w \sin(x) + \sum_{n=1}^{3(n-1)} \sum_{n=1}^{3(n-1)} \phi \cos(x + x) + w \sin(x + x) + n n n q=1 n q n q \]

\[q n q n q \]

\[\sum_{n=1}^{8} \left[ \theta_{nm} \cos(x_n + x_n + x_n) + \omega_{nnn} \sin(x_n + x_n + x_n) \right] + u i t + v i t (6), \]

Where TC is the natural logarithm of total costs (Operational costs plus Financial costs), Inyi is the natural logarithm of bank outputs, In pi stands for the natural logarithm of i-th input prices; the xn describes, n=1,...,n-1, are values of the ln pi / pn-1 , i=1,2, with the values within the interval [0, 2], describing the number of radians (Description of variables as in Al-Jarrah I., Molyneux P., 2006). The bank inefficiency scores are then calculated form the as the expected value of the inefficiency, derived from the frontier, with the difference for the profit efficiency denoting the the expected value of the negative of the inefficiency term. CEkt =
\( \exp(\text{ui}) \) and \( P_{EFkt} = \exp(-\text{ui}) \) resulting in the (in)efficiency with the scores in the range 0 to 1. To determine the scores of cost efficiency, the formula \( CEF_{kt} = 1/CE_{kt} \) has to be used.

### 3.2 Data Envelopment Analysis (DEA):

A type of deterministic frontier analysis is Data Envelopment Analysis (DEA), which uses linear programming methods to build non-parametric frontier isoquant over the data. The efficiency of each DMU is compared to the best performing DMU which is used as a reference. Charnes et al. (1978) has introduced the first DEA technique by employing an input-oriented model with Constant Returns to Scale (CRS). The highlight assumption of this model was that DMUs operate with a constant return to scale, which means that a proportionate increase in inputs would lead to a proportionate increase in outputs, symbolically \( k \ast f(X_{it}) = k \ast Y_{it} \). This assumption is more rigid in nature and is valid only when the DMU operates at an optimal level of production. However, in the real world scenario, the production and efficiency are affected by circumstances such as government regulations, imperfect competition or financial constraints. Hence, as these circumstances affect the production efficiency of a DMU, they affect the technical efficiency of the DMU as well. Matching this DEA model and constant returns to scale assumption with the banking sector characteristics, it is visible that this model of is not perfect for banking data and characteristics. (Coelli, et al. 2005). A model with Variable Returns to Scale (VRS) is more appropriate for the banking sector nature, which takes into consideration the relationship between the scale of production efficiency and the technical efficiency, the model exactly which was introduced by the study of Banker et al., (1984).

**Data Envelopment Analysis Constant Returns to Scale (DEA CRS) model:**

The DEA CRS model is based on the assumption that data is available for \( X \) number of inputs and \( Y \) number outputs of \( i \) number of banks. The \( i \)-th DMU is represented by vectors \( x_i \) and \( y_i \). The following sums up this model:
\[
\begin{align*}
\text{max} & \quad \sum_{k=1}^{8} u_k y_{kp} \sum_{j=1}^{m} u_j x_{jp} \\
\text{s.t.} & \quad \sum_{k=1}^{8} u_k y_{ki} \leq 1 \forall i, v \geq 0 \forall k, j, \sum_{j=1}^{m} u_j x_{ji} \leq k_j 
\end{align*}
\]

(Assume \(i\) banks, each producing \(m\) different outputs using \(n\) different inputs)

where \(k = 1, \ldots, s, j = 1, \ldots, m, i = 1, \ldots, n\) and \(y_{ki}\) denotes output \(k\) produced by bank \(i\), \(x_{ji}\) stands for input \(j\) used by bank \(i\), \(v_k\) and \(u_j\) are weights given to output \(k\) and input \(j\).

Using the Charnes-Cooper transformation, which assumes the denominator of the ratio (the weighted sum of inputs) as one, with the intention to decrease the number of possible solutions from infinite to the multiplier form (linear programming). To derive the data envelopment form of this optimisation problem, I can use the duality principle of linear programming:

\[
\begin{align*}
\text{min} & \quad \theta \lambda \\
\text{s.t.} & \quad -y_0 + Y\lambda \geq 0, \quad \theta x_0 - X\lambda \geq 0, \quad \lambda \geq 0 \quad (8) \quad 24
\end{align*}
\]

where \(\theta\) is a scalar and \(\lambda\) is a vector of constants.

As the envelopment form has less constraints than the multiplier form, it is considered relatively easy form to use which becomes more suitable too. \(\theta\) is the efficiency score obtained for a ranked DMU whose value lies as \(0 \leq \theta \leq 1\). Again, a score of 1 would denote that the DMU is on the best production frontier and a score of less than 1 would denote room for improvement for the DMU using technical efficiency. These DMUs can be labelled as partially inefficient DMUs. In our sample, linear programming would be solved for each DMU to arrive at the efficiency score.
3.3 Selecting the most relevant model: Stochastic Frontier Analysis Versus Data Envelopment Analysis:

Now I have an idea about the functioning of both the models that I will use in our empirical analysis. Each of them has its own advantages and disadvantages, and in order to determine the most relevant model for our study, I will initiate a comparative study of these methods in relation to our data. In the DEA model, there is an ease regarding the non specification of the fu national form of production of the DMU. This input to output oriented analysis envelops data and lies to the assumption that the units are a part of collectible dataset. The DEA model becomes sensitive to extreme values in some cases, which can be a random error for example.

There are a number of reasons which can make an observation atypical. Bad coding and extreme characteristics which don’t relate to the population in the dataset which causes a hinderance in the comparison can are two of these reasons. As DEA encompasses the assumption that the inputs can be varied in quantity to derive the desired amount of output, this might lead to a limitation for need for properties of linear homogeneity and concavity in inout prices. Labelling variable inputs an outputs as constant could lead to partial results. This would induce us to exclude some of important inputs and outputs from our study when I employ the DEA model. However on the brighter side, there is no need to determine the fictional form of the production characteristic of the DMU as the significance of the input to output relation is more prominent here. Hence when I add more inputs and outputs to the optimisation challenge, I can derive a higher efficiency score. As there exists a sampling error when I use a smaller number of samples in our data to research on a particular effect, the same limitation affects the DEA analysis as well. On the other hand, as the efficiency is compared to the best production practice DMUs, a higher number of samples in the analysis may also result in distorted results. Thus, to minimise the impact of relative competence of managers in the banking industry where the inputs are vastly heterogenous within a huge section of data, differentiation between single groups can be done. (Coelli et al. 2005).
The primary advantage of the SFA model over DEA is that it has a better ability to absorb and account for random errors which leads to better estimation of the efficiency scores. Another important advantage is that the SFA model allows hypothesis testing in the model as well. This is necessary as the environment surrounding the banking industry is subject to significant uncertainties and then the estimation of efficiency scores becomes relevant in an environment of volatility. While SFA has its advantages over DEA, it lags behind in the sense that the model heavily depends on the specification of the kind of a production frontier a DMU lies upon, termed as the functional form, and also on the distribution of the inefficiency form which can be difficult to generate in the banking industry given the complexity of the nature of inputs and outputs in the industry.

Hence, after understanding all the models along with their modifications mentioned above and also making room for the significant assumptions undertaking each one of them, the SFA model clearly emerges more relevant to our study. This choice is based upon the fact that the data on banks would be not hugely sensitive and also the fact that I would be able to account for technological change/growth. I can also benefit from the notion that variables related to the production function do not have to be necessarily a part of the input chain. DEA’s inability to account for multi-period optimisation and encompass risk in the management decision making process also sets the stage clear for SFA model for our study. Our conclusion is also in agreement with the conclusions set out by the study of Fiorentino et al. (2006), which sets out the SFA model as more relevant than the DEA in an environment similar to that as characterised by the banking industry.
4. Data Analysis/ Findings

4.1 Data Analysis

In this section, I will describe the data set that I would be including in my research. I have chosen a sample of 28 countries based in European Union in order to estimate the impact of regulations on the development of the financial sector in these countries under the common umbrella of the European Union. The economic policies in this region have been unified to a certain extent while at the same time maintaining each country’s own sovereignty. These countries are: Sweden, Slovenia, Slovakia, Romania, Portugal, Poland, Netherlands, Malta, Luxembourg, Lithuania, Latvia, Italy, Ireland, Hungary, Greece, Britain, Germany, France, Finland, Estonia, Denmark, Czech Republic, Cyprus, Croatia, Bulgaria, Belgium and Austria.

The database includes yearly time series for all variable to be used in the study and are derived primarily from two main sources: Bankscope and WorldBank databases. in the time period between 2004- 2015, which is five years before the financial crisis, and ten years after the financial crisis, in the context of our research question. All numerical data has been adjusted to have Euro as a common currency (in thousands) and appropriate symbolic denotations.

Given the nature of regulatory and accounting rules are different in different countries mentioned above, deriving a standard template of data from the sources was not easy, as for example certain countries have a different financial reporting year, or certain disclosures and variables that are of different reporting requirements in accordance with the rules set in that country. Hence, editing the data was an essential part of obtaining the final database. The final sample was arrived at after considering for these adjustments and finally 836 banks from 28 countries made way to this report. It was not possible to include data for the years from 2016 to 2018 as it would have become a huge database and been impartial towards the data for the pre crisis period. Also, there have been a lot of global events from 2016 which have completely overturned the models of financial estimation. For example, countries like USA, Britain are moving towards the notion of self focus and away from
globalisation. This creates stress on the models that I am going to use as these models have not been designed to accommodate these kind of temporary but global phenomenons having wide global reach, but are expected to normalise in due course of time. Hence, a database of 5 years pre crisis and 8 years post crisis is appropriate in terms of volume and relevance to achieve the purposes of this study. The filters applied have resulted in a dataset of 7525 bank year observations. 

(836banks * 12years - filtered observations)

4.1.1 Bank Characteristics:

To determine the efficiency of the banks used in our study, I have decide to use the 3 output-input model which is a multi product function model. There are several metrics on the profit statement of a bank which denote indicators in accordance with the literature that I have reviewed, but I have decided to use (i) variable total costs and. (ii) profit before tax as the dependent variables, considering the difference in taxes and accounting treatment for fixed costs in these sample countries.

For the cost efficiency aspect of the model, a bank’s Total Cost (TC) appears to be the the most suited dependent variable, which is a sum of all expenses including interest costs on borrowed funds of all types, operating expenses and overheads that are not related to the borrowed funds. For the profit frontier, I used the Profit before Tax variable, which is arrived at by deducting all expenses (financial and operating) , before reducing tax expenses from the revenue generated by the bank.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Label</th>
<th>Description</th>
<th>Unit</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total costs</td>
<td>TC</td>
<td>Sum of interest expenses and non-interest expenses</td>
<td>Thousands of Euros</td>
<td>BankScope</td>
</tr>
<tr>
<td>Profit Before Tax</td>
<td>ProfitTax</td>
<td></td>
<td>Thousands of Euros</td>
<td>BankScope</td>
</tr>
</tbody>
</table>

**Explanatory Variables**

<table>
<thead>
<tr>
<th>Output variables</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Loans</td>
<td>Q1</td>
<td></td>
<td>Thousands of Euros</td>
<td>BankScope</td>
</tr>
<tr>
<td>Other Earning Assets</td>
<td>Q2</td>
<td></td>
<td>Thousands of Euros</td>
<td>BankScope</td>
</tr>
<tr>
<td>Total Deposits</td>
<td>Q3</td>
<td></td>
<td>Thousands of Euros</td>
<td>BankScope</td>
</tr>
</tbody>
</table>

**Input Variables**

| Price of Borrowed Funds       | P1       | Interest Expenses/ Total Deposits  | Thousand of Euros  | BankScope |
| Price of Physical Capital     | P2       | (Overheads- Personnel Expenditures)/ Fixed Assets | Thousand of Euros  | BankScope |
| Price of Labor                | P3       | (Total Personnel Expenses)/ (Total Assets) | Thousand of Euros  | BankScope |
| Technical Efficiency          | EQUITY   | Equity Capital                     | Thousand of Euros  | BankScope |
The output section of the model equation includes Total Loans which is the sum of all loans and leases adjusted by unearned income (excluding foreign loans), Other Earning Assets which is the income generated by banks on all assets other than customer loans and Deposits which is the sum of all deposits a bank accepts in the year. Input prices section of the equation comprises of Cost of Borrowed Funds which is the total interest and financial expenses on deposits accepted, Cost of Physical Capital which is the annual running expenditures required to keep running all assets that the bank has such as IT infrastructure, Intangibles etc. but excluding personnel expenses.

For the econometric part of the analysis, the impact of regulations and supervision is the focus of our study. I have considered rules about the foreign ownership structure that have been imposed on banks. A bank is said to be a foreign bank when more than Half of its capital is owned by a foreign entity. Since risk forms a key part of the reasons why regulations have been imposed on banks in times after the financial crisis, I also include risk related variables such as risk costs, risk aversion factors such as rational management decision making process and risk exposure of the assets of the banks.

These variable risk costs indicates the quality of assets employed by the banks in comparison to the non performing or loss making assets. This ratio has a negative impact on the bank efficiency score and thus higher the ratio, it would mean lower efficiency score for the bank. The ratio can also be understood to be derived from the management competency and measures adopted and policies introduces to reduce the loss making assets of the bank.

To describe the impact of management decision making techniques, the measure of Equity to Total Assets serves as a reliable indicator by determining the extent of assets which are funded by owners capital. The higher the ratio, it would signify that the bak would rely less on external funds to fund assets and instead have the confidence to fund its assets using own capital and eventually assign a higher efficiency score to the bank.
The variable of bank size is also used in our empirical analysis to account for the impact of a bank’s strength and financial dominance in the markets with the kind if impact these factors may have on its efficiency.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Label</th>
<th>Description</th>
<th>Unit</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign owned banks</td>
<td>Foreign</td>
<td>Variable describing the foreign bank ownership banks; considering bank as foreign owned if more than 50% are owned by foreign shareholders; dummy variable taking the value 1 if the bank has an foreign institution as an owner, 0 otherwise</td>
<td>0;1</td>
<td>BankScope</td>
</tr>
<tr>
<td>Global Financial Crisis</td>
<td>GF_crisis</td>
<td>The variable expressing the global financial crisis; dummy variable taking the value 1 for the year of Global Financial Crisis 2009-2013, 0 otherwise</td>
<td>0;1</td>
<td>BankScope</td>
</tr>
<tr>
<td>Risk costs</td>
<td>LLP</td>
<td>Risk associated with loan provision; (loan loss provisions)/(gross loans)</td>
<td>%</td>
<td>BankScope</td>
</tr>
<tr>
<td>Risk aversion</td>
<td>Equity/Asset</td>
<td>Equity to assets ratio (Equity)/(Total Assets)</td>
<td>%</td>
<td>BankScope</td>
</tr>
<tr>
<td>Performance</td>
<td>NIR</td>
<td>Net interest revenue; performance ratio of bank</td>
<td>%</td>
<td>BankScope</td>
</tr>
<tr>
<td>Size</td>
<td>Size</td>
<td>Total assets</td>
<td>Pure Number</td>
<td>BankScope</td>
</tr>
</tbody>
</table>

4.1.2 Regulation and Supervision Characteristics:

For an analysis of impact of the regulatory and supervisory rules on the banks in the aftermath of the financial crisis as well as the pre-crisis period, results from the BRSS Survey by the World Bank serves as an excellent source. This rich source is a comprehensive collection of how banks around the world are regulated and supervised in various terms the survey runs from. This survey also provides us with the most desired aspect of our study, which is the data containing the impact of regulations as well the circumstances which led to the imposition of additional regulatory and supervisory rules in the aftermath of the global financial crisis. This would serve as a focal point to have a comparison available between the pre-pre-crisis impact of regulations versus the impact of regulations and supervision in the post-crisis era on banks.

To make the data from the Bank Regulation and Supervision Surveys fit for our study, I have to format them to extract the relevant bits out and usable for the purposes of this study. I will now provide groupies description on the kind of
regulations banks are supposed to comply with and assign them a scale value on 1 to 8. In the following part, I will provide a brief description of some of the financial regulation instruments used in this study.

The first category of restrictions in the restrictions imposed on banks to engage in the scale and scope of businesses they are interested in. These include fee/commission based businesses which are in departure of the traditional method of money making by banks. The major restrictions are:

1. **Restriction to engage in Securities Activities**: These are the restrictions imposed on banks to engage in the businesses of underwriting, brokerage, pooling and securitisation of funds, which formed the main basis of separation of commercial and investment banking activities carried out by a single firm with the risk of a conflict of interest and safety of investors in the Dodd Frank regulations,

2. **Restriction on insurance related activities** measure the restrictions affecting the banks to engage in insurance underwriting and selling insurance related product using the same channels as they use to sell their core banking products

3. **Restrictions on Real Estate activities**: This category looks upon the banks ability to engage in real estate assets dealings such as mortgages, prime lending and sub prime assets, which were the main instruments that led to the financial crisis and bubble burst in the US markets and eventually had a global footfall.

The range of these restrictions can be assigned as between 0 to 4, with a higher score indicating more restricted zones. A scale of 1 means unrestricted access, 2 would indicate permitted businesses, 3 would be restricted and a scale score of 4 would mean prohibited activities. Although there seems to be minor difference between any two consecutive scores, the sense on which the governments consider the activities can have a huge impact on deriving the efficiency scores for these banks. To have an simpler understanding of the collective effect of these restrictions and categories on the efficiency of the bank, I can assign a weighted average of these categories by formulating an index. This entails the intention to simplify our
model inputs and variables while at the same time preserving the sanctity of the data I have collected.

**Auxiliary Business Restrictions/ Conglomerate Restrictions:** These variables are constructed to measure the restrictiveness index between a bank’s core businesses and other commercial interests. These are themed as Ownership Restrictions: (i) This measures the impact of restrictions when banks maybe able to have a financial and operating interest in non-financial firms (Own_firm), (ii) the measure of restrictions when non-financial firms have an ability to participate in the ownership and operations of banks (firm_own_bank) and (3) the measure of restrictions about the interest of non-banking financial firms in the operation and ownership of banks (nonbankfin).

A weighted average score of all the three above mentioned restrictions (overall_req) has been derived based on the functioning of each of these parameters. The scale can be assigned again as having values between 1 to 4. (1 meaning unrestricted, 2-permitted, 3-restricted and 4- prohibited).

**The variables relating to the restriction of Foreign ownership and Entry requirements** are used as a measure under the concept of competition regulation.

1. Entry/Ownership Restrictions: These measure the restrictions that are imposed on the banks having a foreign based ownership structure as well as the difficulty with foreign banks can enter the domestic banking space in a country (Limit_foreign),
2. Legal Requirements: This measures the ability of the new banks to obtain the licences and permissions to operate their proposed businesses in the domestic markets (entr_bank).

Another variable which has gained crucial importance in the recent years and the years post the crisis is **capital requirements (cap_reg)**.

1. Initial Capital Requirements: This specifies the sources of regulatory capital that is required to be maintained by banks as a minimum requirement as a percentage of
the total capital structure while also mentioning qualifying and non-qualifying components of this regulatory capital in forms such as borrowed funds, government aids, cash and illiquid assets.

2. Overall Capital Requirements: This measures mention the overall capital the bank must hold as its own funds to support the business in the event of any shock to absorb the losses and protect the investors for malign interests of the banks. These requirements mention the rules regarding computation, disclosure, maintenance and compliance of capital directives issued by bodies all around the world for example JFSA in Japan.

**Power of Supervisory agencies** can be grouped into three categories of variables.

(i) Official Supervisory Power which measures the competence of the relevant supervisory authority to formulate policies, initiate stability inducing measures in event of shocks and surprises and take disciplinary action against non-complying banks, (ii) Stability enhancing regulations and (iii) supervisory structural variables.

The overall sup_pow variable can be calculated as a weighted average of 14 indicators describes in the following categories:

1. **Prompt_Corr**: This is a measure defining the ability of supervisory agencies to initiate prompt corrective action under their powers and the utilisation of the authority which they are granted,

2. **Restruc_power**: This category measures characteristics of regulatory authorities in relation to legislations and rules they bring to the banking industry in case where banks need to be restructured as a solution to a crisis.

3. **Insolv_Pwr**: This category measures the authority and willingness of the supervisory body to declare a bank as an insolvent business in circumstances beyond recovery possibility and after restructuring efforts.

4. **Sup_Forbear**: This category measure the extent to which supervisory authorities can engage in discipline inducing activities against banks who have flouted existing rules and regulations set up around the financial environment of that bank.
5. **Court Inv**: This category measures the extent to which courts can be approached as a nodal appellate authority over the existence of regulatory authorities the bank is subject to.

There is also a set of variables that define supervisory power in terms of their ability to use financial instruments to enhance the stability of the banks with an increased risk concern. These variables can be grouped under three main categories:

1. **Standards to classify loans**: These variables mark the supervisory authority with their ability to direct banks to categorise loans that banks hand out based on factors such as credit quality, risk, and credit worthiness. (Loan Class)

2. **Requirement of Provisions**: These variables define the supervisory power in terms of their estimates to have a set number or percentage of the total debts handed out as risky loans and thus have a minimum separate provision for to ensure that the banks are well equipped to handle shocks in case the provisions for doubtful debts, provision for loss, and standard provisions actually materialise. (Prov Strin)

3. **Diversification**: These variables enable us to allocate ratings to supervisory power in terms of the extent to which they allow banks to diversify their assets in terms of geography and parallel businesses and the kind of guidelines that they are able to set out in terms of risk minimisation and overall financial market regulation. (Divers Index)

Another group of variables that are based on the structural characteristics of the supervisory authority are:

1. **Tenure**: These variables define the minimum and maximum amount of time a bank can have a supervisor for.

2. **Independence**: The overall independence and objectivity of a supervisory authority depends on its ability to exercise independence from the politics of a country, (Sup Ind Pol), ability to exercise independence from the financial division/ministry of a government (Sup Ind Fix) and its ability to save itself and its interests from any unwarranted risk arising from the influence of banks with
legislatures and the government against the supervisory authority.
(Sup_Ind_Bank).

3. **Multiple Supervisors:** These variables determine if the effectiveness and efficiency of the supervisory authority is shared between a number of supervisors. They also define the extent to which the authorities are able to make decisions in sync keeping the overall interests of the financial industry in mind. In our analysis, I have assigned a value of 0 to a situation where a single regulator exists and a value of 1 in case of multiple supervisors.

The financial acumen and success of any country depends on its ability to maintain discipline in the financial markets that it possesses. There are a number of variables that define this market discipline for any country’s financial markets. But I chose the following 3 variables for this section as they cover almost every aspect of the concepts that are touched by other non-significant variables as well.

1. **Private Sector Monitoring:** This can be actually thought of an index on a scale of 1-12 with a lower score indicating higher market discipline by using financial regulatory instruments to bring discipline in the private sector. To define this index, I can further break it down into three variables that when combined make it a composite index: (i) Audit Requirements: This variable defines the requirement which the legislators in the financial markets must have set with the intention to have the financial information being released by these private sector banks and the details of their operational efficiency and concerns are subject to an audit requirement by an independent external professional auditor, (ii) Insurance Requirements: This variable defines the requirement set up by the legislatures to direct banks to provide deposit insurance to the investors and households which deposit money with the banks with the intention to secure the investors in an event of a banking collapse. I assigned values 1 for an existing deposit insurance scheme and a value of 0 when no insurance is provided and (iii) Accounting Requirements: This variable describes the scope of accounting and reporting requirements that are set out by the banks keeping in mind the significant accounting concepts that exist and the option of different banks to exercise...
different accounting rules on their own choice. A value of 1 has been assigned to situations where all accounting conventions such as accrual accounting, consolidation, provisioning and ownership disclosures are duly followed and a score of 0 when they are not.

2. **Moral Hazard Considerations:** This can be thought of as an index which defines if there exist insurance schemes that safeguard the interests of the overall financial systems. This index can be further thought to be made up of factors such as inter-bank deposits security, quality and validity of funding, management prudence and considerations, level and sharing of coverage between multiple insurers, and foreign geographical coverage when assets are invested in a different geography. I assign higher values to higher moral hazard risks on a scale between 0 to 1.

3. **External Governance Index:** Apart from the internal controls that exist in the financial environment of a bank, there also exist a number of external mechanisms which the financial legislatures set up in the country to prove additional assurance. These can be done with the intention to manage debts, comply with legal requirements and fulfill the financial and transparency compliances. I set up a scale of 1-19 for this index with a higher score indicating higher efficiency of external mechanisms and market discipline, and the scale is based upon the scores obtained the three categories: (i) Financial and Accounting Reporting Transparency, which ensures that what actually exists in the business operations is being reported on the financial statement as well without any omission, intentional or otherwise, (ii) Credit Monitoring by External Agencies: This variable provides the creditors of a bank with a tool in the form of an external rating agency or a professional performance evaluator with respect to the risk and incentives that the creditors are subject to while conducting business with the bank.
4.2 Econometric Analysis

In this section, I will apply the Stochastic Frontier Analysis Financial Model to the data mentioned in the previous sections. This will lead to two outputs - (i) the estimation of the efficiency scores as described in the methodology part, and (ii) influence of regulatory determinant variables on the estimated efficiency scores. I will perform this estimation on both - profit and cost estimation models. This will help us have a comparable idea between both cost and profit based models. This estimation will cover data around the financial crisis and describe how the model has been used to derive the efficiency scores and relationship of the variables between each other and the overall efficiency with respect to the regulatory supervision influence. How I have gone about trying to minimise the margin of error has also been mentioned below at places.

4.2.1 Profit and Cost Efficiency Estimation:

As mentioned in the previous sections, I will use the Stochastic Frontier Analysis method to determine the cost and profit efficiency of our data set.

The equation for the cost model is set out as:

\[ \ln C_{it} = C(q_{it}, p_{it}; \beta) + u_{it} + v_{it} \]

Where \( i=1,2,...,N; t=1,2,...,9, \)

Where,

- \( C_{it} \) is the total cost to bank i at time period t,
- \( q_{it} \) is the vector of value of outputs
- \( p_{it} \) Describes the vector of input prices in a suitable form based on a function
- \( \beta \) is the vector to be estimated as it is based on unknown scalar terms
\( u_{it} \) is the non-negative efficiency effects in the model.

\( v_{it} \) reflects the random errors.

In equation above, the term \( z_{i,t} \) is a \((1 \times M)\) vector of explanatory variables that impact the efficiency of the DMU which in our case are banks, and \( \delta \) is a \((M \times 1)\) vector of coefficients that is estimated and mentioned in the intercepts. As I have decided to use the Battesse and Coelli model to help us obtain the efficiency scores in a one step test, by deriving the equations suing MLE. The logic behind this one step estimation is that if the variables to be included are defined correctly in the first place and the overall environmental variables has been considered, there does not arise a need for the second stage as the first stage sets out the results on its own merit.

It is therefore important to define and assess the related environmental variables as a biased and erroneous estimation of the impact of these variables would lead us to distorted results, which would add to the irrelevance of the study for some. Finding support in the existing literature by Pasiouras et al, 2009 and Irsova 2009, I have already mentioned that I would be using the 3 output - input production model imbibing the approach of value creation at every stage of the inputs applied. These 3 outputs are: (1) Total Loans, (2) Other Earning Assets and (3) Value of deposits. Inputs are mentioned in the model in the form of cost of borrowings, fixed costs and personnel expenses.

In the cost frontier analysis I have used total costs to be a combination of financial costs and non-financial costs. Whereas at the profit frontier, I have used the variable called profit before tax. To factor in the impact of technological change, I have also included some dummy variables. To assess the impact of equity as a measure of stability in the ownership structure of the banks, the Equity variable has also been considered. After this, to fulfill the assumption of linear homogeneity, I assigned weights to the terms in the model by the third input - price. Hence, the model of our estimation is defined as:
\[ \ln TC = \beta_0 + \beta_1 \ln(Q1) + \beta_2 \ln(Q2) + \beta_3 \ln(Q3) + \beta_4 \ln(P1) + \beta_5 \ln(P2) + P3 \ P3 \ \text{P3} \]

\[ \beta_6 12 (\ln(Q1))2 + \beta_7 \ln(Q1) \ln(Q2) + \beta_8 \ln(Q1) \ln(Q3) + \beta_9 12 (\ln(Q2))2 + \beta_{10} \ln(Q2) \ln(Q3) + \beta_{11} 1 (\ln(Q3))2 + \beta_{12} 1 (\ln(P1))2 + \beta_{13} \ln(P1) \ln(P2) + 2 \ P3 \ P3 \]

\[ \beta_{14} 1 (\ln(P2))2 + \beta_{15} \ln(Q1) \ln(P1) + \beta_{16} \ln(Q1) \ln(P2) + \beta_{17} \ln(Q2) \ln(P1) + 2 \ P3 \ P3 \ P3 \]

\[ \beta_{18} \ln(Q2) \ln(P2) + \beta_{19} \ln(Q3) \ln(P1) + \beta_{20} \ln(Q3) \ln(P2) + P3 \ P3 \ P3 \]

\[ \beta_{36} \sum_{n=1}^{8} [\cos(xn) + \,pn \sin(xn)] + \beta_{36} \sum_{n=1}^{8} \sum_{m=n}^{8} [\cos(xn + xm) + \,pnm \sin(xn + \,xm)] + \beta_{37} \sum_{n=1}^{8} [\cos(xn + \,xn + \,xn) + \,pnnn \sin(xn + \,xn + \,xn)] + \beta_{21} \ln(E) + \beta_{22} 12 (\ln(E))2 + \beta_{23} \ln(E) \ln(Q1) + \beta_{24} \ln(E) \ln(Q2) + \beta_{25} \ln(E) \ln(Q3) + \beta_{26} \ln(E) \ln(P1) + \beta_{27} \ln(E) \ln(P2) + \beta_{28} Y2006 + P3 \ P3 \]

\[ \beta_{29} Y2007 + \beta_{30} Y2008 + \beta_{31} Y2009 + \beta_{32} Y2010 + \beta_{33} Y2011 + \beta_{34} Y2012 + \beta_{35} Y2013 + \ui + \vit \ (11). \]

The terms included in the bold indicate the model described the Fourier Flexible functional form by adding the Fourier Trigonometric terms, where \( x_n \) terms, \( n \) and \( m = 1\ldots8 \) is a substitute for values of the \( \ln(p_i/p_3) \), \( i=1,2 \) such that the variable \( x_n \) describes the number of radians.

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Table 3: Summary of Efficiency Variables, (Source: Summary, Workings)
5. Results and Discussion

Here I provide a discussion of the results of the regression results that I have obtained using the Stochastic Frontier Analysis method.

Restriction of the scope of banking activities has a significant impact on the cost and profit efficiency of the banks. The impact of the variable `restric_act` has been derived to be negative which indicates the unfavourable impact it has on the efficiency of banks. These results are in sync with the studies conducted by Barth (2013) and Chortareas (2010), implying that placing stronger restrictions on the scope and nature of a bank’s activities may reduce the ability of the bank to generate income from diversified sources and also allocate its risk to various asset classes. This may lead to the increase in the burden on banks while also providing an incentive to the management to indulge in unethical practices. This may also ultimately lead to the lag in the quality of services and products provided by the banks to its customers.

We have found a significant positive impact of the variable of imposing restrictions on the banks to indulge in conglomerate businesses. (overall_req). The higher the restrictions on the banks to indulge in non-banking businesses, the higher the efficiency of the bank. Phrasing this in other words, it is good for a country if its banks stay in the banking industry as their primary businesses.

There has also been derived positive influence on the efficiency of banks when there are restrictions placed on the entry of new players in the financial markets and also when higher restrictions are placed on foreigners to engage in the business in foreign markets. This result syncs with the study of Kim (2013) where it was implied that higher barriers to entry in the banking space may increase in the incentive for existing banks to not engage in speculation, which might become a necessary choice if the banks are faced with excess competition and uncertainty.

Surprisingly, the impact of Supervisory powers that are rested with the authorities did not have as significant an impact as I had hoped while going through the literature review related to this variable. Although higher power for the regulators lead to better
governance, improve performance and reduce the incentive to indulge in unethical practices by banks, the impact on cost and profit efficiency has been not significant. This result would have been in agreement with the study of Pasiouras (2009) if the aspects an impact of private sector monitoring and were included in the powers of the traditional banking supervision space as well.

The effect of stronger rules about the provisioning requirements for doubtful debts in a bank’s asset structure has found to have a significant negative impact on the bank’s profit and cost efficiency. An increase in the cost in the form of provisioning requirement of the total deposit base for a bank is unfair as this provision number is to be derived from the balance sheet while the impact of this provisions hits the Profit and Loss statement of the banks, thereby affecting our variable Profit before Tax. This variable can also be stated to have an indirect impact of poor management decisions and asset management techniques employed by the bank’s asset managers which places further burden on the LLP variable.

The variable Supervisory Independence ($Sup\_Ind$) is the degree of overall independence that banks are able to exercise form the political system and the influence of banks and corporates in the financial world. The positive impact on efficiency implies that a higher degree of independence increases a bank’s cost efficiency. Phrased otherwise, it might also mean increased costs for the banks if the supervisory authorities aren’t able to exercise independence and impose decisions and rules which are biased and favour some interested parties. This leads to operational inefficiencies for the banks and an increased chance of a crisis. This derivation is also in sync with the study of Barth (2013). This is true for the entire period of our study, but in the period post 2008, there is shown to be a positive impact not only on the cost and profit models, but also on the performance and volumes of the banks.

The Capital Adequacy Restriction measures like Basel norms and Capital Requirements Directives (CRD) which are imposed on banks ($cap\_reg$) has in our model generated positive results on the cost efficiency of the banks. This is in agreement with the studies of Pasiouras (2009), that stricter capital requirements
would lead to a higher own capital level at the banks and would in turn mean that the bank would have to invest lesser sums of money in risk management activities. This would also enable banks to invest their capital in good quality assets as directed by the Tier I and Tier II requirements mentioned in the Basel norms and also about the quality of assets that are eligible to be considered as qualifying assets to meet the capital adequacy restrictions levied by the regulatory authorities. The impact of Initial Capital Requirements and Overall Capital Requirement variables has also been negatively and positively related respectively. This result is also based on the factor that financial markets have developed in such a way today that the initial sources of capital and the overall capital requirements can be met using the well developed stock markets in these individual countries, rather than meeting the requirements through capital compliances, which leads to a potential decline in the bank revenues.

Surprisingly, the impact of the variable of Multiple Supervisory Authorities (MultipleSup) has been found to be otherwise than was expected after going though the relevant literature review themes, The study in our model derived that when multiple supervisors are present in a bank’s environment, it leads town increase in efficiency with which the banks operate. In other words, when there is a unification of multiple supervisory agencies to one single agency, it leads to a decrease in the profit efficiency, which emphasises the fact that in this era of emerging financial concepts and the complexity of businesses, it is necessary that specialised regulators also exist which would serve the purpose of regulation rather than having one agency which is not able to operate at full technical and regulatory capacity. This theory has also been supported in the study of Caganis (2013).

Considering our database and the nature of information I have on the wide geography that I have considered, it is not possible to arrive at unified regulatory policies that work well across all the geographies that I have included in our study. Countries in the European Union are able to exercise a great degree of sovereign authority to act in response to the developments in the regulatory space in that country. This is the reason why I have considered variables that are relevant across all the 28 countries of our study such as activity restrictions, capital requirements, independence of agencies and others.
The variables of Private Monitoring and Moral Hazard have been seen to have a great degree of impact on the cost as well as profit efficiency of the banks. Higher degree of private monitoring works in favour of banks which are subject to high regulatory compliance requirements which places burden on their cost and profit efficiencies. Thus, when the private sector is also subjected to some compliances, it leads to an increase in the level of transparency and market discipline, which has been confirmed in the studies of Chortareas (2010). The variable of Moral hazard (Moral_Hazard) describes the effectiveness of the supervisory authority to mitigate any possibility of moral hazard indulgence by banks. The impact of this variable has been found to be negative despite the fact that there in an increase in the overall market discipline. This outcome can be attributed to the facts that insurance and security requirements imposed on the banks with respect to its investors and customers places an additional burden on the bank’s cost structure while at the same time discouraging them from engaging into high risk activities (which are assumed to lead to an increased chance of higher incomes). This leads to decline in the profit efficiency as well in the short run. In the long term, however, it might lead to an increase in the overall confidence in the banks by investors. The years of our study show an increasing trend of sensitivity to these variables in the efficiency of the banks.

In the model specifying the restrictions placed on activities of banks related to securities and insurance, both have resulted in a negative impact on both the cost and profit efficiency of the banks. This means that an increase in the diversification of income streams through non-traditional sources leads to an increase in the overall efficiency of the bank. In the model, I observe the high significance during the financial crisis period.

The Financial Conglomerate restrictions variable results in an increase in the efficiency of the banks based on the theory that restrictions placed on the ownership of non financial firms by banks results in a decrease in the overall risk exposure of banks which may lead to an increase in the efficiency.
All our regression results indicate the significant positive impact of the overall independence that a regulator is able to exercise. The three variables which I have used are: Supervisor Political Independence, Supervisor Bank Independence, Supervisor Tenure and Supervisor overall independence. All of these have seen to bring significant positive results to the bank’s cost efficiency as higher duration of tenure and increased independence leads to a decrease in the volatility of the regulatory environment which enhances the stability in turn leading to increased efficiencies.

All the variables connected to market discipline and external certification are found to have a positive impact on the bank’s efficiency in general. \textit{Strength\_audit}, \textit{Financial\_T}, \textit{Accounting} and \textit{ExternalRating} are found to be connected to the enhancement of the overall stability, quality and soundness of the financial environment of the banking environment. During the crisis period there was an increase in the number of variables that had a negative impact on the profit as well as cost efficiency of the banks. Ratings, Reporting and Auditing requirements place an increased burden on the costs of a bank resulting in lower profit margins. However, the impact of Strength of an audit has been found to overpower the cost associated in its conduct which has resulted in a positive influence on the banks in the form of higher transparency and stability associations.

Foreign Ownership has found to have been negatively correlated in the model for the countries who are members of the EU. One of the explanations related to the negative impact can be understood as redistribution of costs from the parent to its foreign based subsidiary or vice cress which also leads to an increase in the transaction costs for the banks.

The variable of Diversification Index has seen to have a significant negative impact during the period leading to the financial crisis. The indulgence in risky instruments was in itself a call for stricter regulations in the financial markets. In the periods post crisis, the need was felt to have lesser restrictions on the diversification portfolios of
the banks as now it was essential to actually diversify in safer assets to save the banks from further collapses. The variable of Real Estate investment activities has found to have been having a negative impact on the results for the entire period of the study.

The variable of Prompt Corrective Action by a regulator has found to have a negative impact on the bank's efficiency. This result is mostly a result of the increased stress on banks to comply with the regulations which are found to be excessive in nature as the regulators are considered to be harsh in the short term which places burden to the efficiency of the banks.

Figure 1: Profit Efficiency Scores: Overall vs Crisis Period.

From the above figure, I can deduce that the profit efficiency scores are almost more than the 56% slab for most of the countries in the EU. The lowest efficiency is
exhibited by Lithuania (54%), Greece (48%) and Romania (49%). The highest score is obtained by Czech Republic (81%) which is followed by Poland and Denmark at 76% and 73% respectively. There has been a relatively safe and sound profit efficiency score when this is compared to the crisis period, for example the highest fall is only at a 5% drop scored by Greece, Ireland and Netherlands. Interestingly, there were some countries that apparently seemed to benefit from a more informed reaction to the crisis that it actually led to an increase in their efficiency scores. These are: Luxembourg, Denmark, Bulgaria, Cyprus and Romania by approximately 1% each.

Figure 2: Cost Efficiency Scores: Overall vs Crisis Period
Figure 3: Profit Efficiency Scores - Domestic vs Foreign Banks (Source: Summary, Workings)

Figure 4: Ownership of Foreign Banks (source WorldBank database)
Comparing the cost efficiency scores versus the profit efficiency scores, it is clearly visible that banks are better at cost management than profit management at an overall level. The cost efficiency score is generally higher for all countries than compared to their own profit efficiency, but in the case of Greece there is a significant difference. Although it is operating at a high cost efficiency level, it has not been able to transform this efficiency to drive revenues and maximise profits. A similar case if for Ireland, but Ireland could be thought of as a multiplication of problems during the crisis as various economic situations existed for the country apart from the crisis, which leaves only a part of the blame for the efficiency gap on the global financial crisis. During the crisis period, Denmark and Czech Republic were the two counties which portrayed balanced efficiency scores which ensures the investors and customers in these countries that the banking environment is relatively stable at is operating at an efficiency level well beyond other countries.

The workings related to the above figure indicate a significant interest of foreign entities in the other geographies across the European Union. Luxembourg exerts a higher level of attractiveness to all investors given its favourable regulations and incentive to investors. The prominent decline in ownership structures due to the effect of the crisis were in Britain, Ireland and Czech Republic (by approximately 10% each). Slovakia on the other hand reflected an exactly opposite statistic representing an increase of 10% in the post crisis period.
Conclusion

I have tried to extend the literature available on the current aspect of the regulation scenario with respect to the events that shaped up the present such as the financial crisis of 2008. This was done with the aim to link efficiency in the banking space to the regulations they are subject to in different time periods. The sample of this analysis consisted of 7525 observations over a 12 year period across 28 countries in the European Union. Considering the difference in claims of superiority of literature in this field, the focus under consideration in this study was capital restrictions, scope of business restrictions, independence of the supervisory authority, private monitoring and market discipline as the major components.

This study confirms the existence of patterns in the assigning of efficiency scores for the countries in the European Union which I have selected for the purposes of this study. Primarily, it can be concluded that a higher efficiency of management in the management costs would not automatically lead to an increase in the bottomline efficiency.

Regulations have a significant effect on the survival and existence of banks in these 28 countries in the European Union. When I consider higher regulations restricting the activities that banks can engage in, it leads to a decline in the cost efficiency while not allowing the banks to benefit from diversification of risk. Also, strict activity rules may not allow banks to process market information efficiently and ultimately increase the chances for another crisis. In our analysis, I also derived that banks which engage in extended financial services businesses such as securities and insurance businesses benefit from an increase in their overall efficiency. The independence of a supervisory authority also plays a vital role in ensuring that the financial markets are run considering the interests of all market participants in mind and not only the participants who are bale to exercise significant influence inclined towards their own interests at the cost of unfair dealings. Also, the tenure with which the supervisory authority reigns in power is also directly related to the efficiency of the banks. In our study I see that in time of crisis between 2009-2011, banks were increasingly sensitive to the independence of the supervisory authority and their
tenure in office as it minimises volatility related to the regulatory environment change. The impact of the third pillar of Basel norms which is higher private sector monitoring has also been shown to have an important effect on the determination of the banking efficiency of EU countries. This leads to a confidence that markets as a whole would operate under rational decisions and that information will flow smoothly and efficiently without any undue advantage to the firms not subject to regulatory requirements.

Also as per our regression analysis, I can conclude than an increase in the strictness of external rating practices and accounting/reporting requirements leads to an increase in the cost efficiency of banks as well whereas the profit efficiency or revenue remain unchanged and in some cases are even negatively influenced.

Regulatory norms like Basel III and CRD IV directives initially were met with the resistance that they could hamper bank efficiency. The presence of a single strong authority might also lead to an inefficiency of the markets, But our study has suggested that his might not necessarily be the cases in most organised and stable financial markets.

In the end, I can also conclude that the impact of regulatory variables on the cost efficiency, profit efficiency and survival of the banks is widespread and that much more research and challenges are unexplored in the field which would result in additional conclusions. Our study provided an overview of the adequacy and impact of regulatory variables in the pre and post crisis period on the functioning of the banks while also indicating that a increase or decrease in the strictness of the regulatory aspects would lead banks towards a certain direction in future as well, depending upon various factors and developments in the financial markets.

There remains scope for further research on a more technical break down basis. For example, one could attempt to decompose the total volatility into systematic and idiosyncratic components and verify the effects of changes in each. Another study could be taken up by increasing the time period of analysis around a major global financial crisis event. One peculiar feature that demands more research is the impact
of shadow banking on the overall financial markets in general. This would involve
digging deep into the functioning of these banks which work around the transparency
requirements and it would be exciting to see studies in this field and the kind of
trends that evolve out of that study. This would obviously be very demanding and
data would be tough to pull up, but still the scope exists if a researcher has
appropriate resources to put into use to. Also, more studies could be taken in other
geographies, such as American, Chinese and Islamic Banking areas where there
has been a lot of action in the financial space recently. These geographies are
subject to specific regulations peculiar to their country and sometimes even religion
comes into play, which would make it interesting to see how religion affects the
financial markets in a greater sense and whether there is as good discipline where
the regulations are based strictly on economic considerations and not religious ones.
There is also this concept which has emerged in the recent years which is called the
dual banking system in a single geography which suggest the existence of traditional
as well as modern financial systems in a parallel playing field with neither of them as
at a disadvantage. There are many gaps in the literature that I have around this topic
and this is exactly the reason why I chose to accommodate the kind study that I have
done in this paper.
Reflective Learning

This year has been an amazing one based on academic rigour and curiosity. Coming to an English inspired working system here in Ireland was an entirely different cultural as well as academic shock that I had took upon myself as a challenge in the first semester itself. I formed an outline what I had to achieve this year in 2018 and the set of skills that I had to imbibe in myself as envisioned in the course structure, objectives, learnings and growth plans.

The outline of the course was a very comprehensive one, which helped me move a step ahead of my specialisation in accountancy earlier and have a more management oriented focus and look at things from a senior management’s perspective. This will help me immensely in planing my career ahead and sorting my priorities as a soon to be finance professional with a possibility to speed up my progress chart using the management techniques learnt from the entire duration of the course. Abstract values such as respecting the time of your stakeholders, keeping presentations and arguments to the point in a clear and concise way which leads to logical decision making, acknowledging the efforts of teachers and program managers for setting up such a fantastic level playing field for a class full of diversity and conflicting views.

Technical skills and concepts were at the core of the modules and our professors did a fantastic job at making it easy for us to get a good grip on the concepts. Modules like Corporate Financial Management, Operation and Governance of Financial
Markets and Financial Analysis encompassed this aspect of learning in this semester. The professors even explained the relevance in the real work situations which I found completely new and relevant when compared to the earlier education system I was present in. Financial Modelling, theories and the use of these concept in actual official working space with related assignments not only help us have a theoretical understanding of the subject, but also have an inside desire to contribute to the learning of the course. Methods like Ratio Analysis, Equity research and balance sheet analysis further developed my financial acumen and now I am confident to be able to dig data on most of the market indexes and components that I would need to work on at some point of time in future.

Modules like Business Strategy, Performance Driven Marketing and International Management inspired me to have an overall outlook of a business while understanding the needs of every unit that a firm is made up of. This division specific learning would definitely be of help in understanding the complex nature of activities taken at these functional units and what it takes to get ahead as a leader and inspire the team to perform. These modules also gave me a sense of broad outlook beyond one’s own business and even a country to think of financial markets as a global space. The theories that distance has actually reduced between different financial markets across the world was realised first hand here in Dublin and that the turf for success is not far to achieve. This has helped me install a sense of immense confidence to grow. Modules like Research Methods helped me to derive the technical skills to derive and accumulate data from credible sources and what it takes to derive logical and evidence based results from this research. The facts can then be put to use to take business decisions which would help me again to make
relevant decisions in my workspace and make valuable contributions based on proper research. Personal and Professional Development modules help me have a chronological assessment of my progress in the semesters, while making me realise the importance of social contribution as well. There are things beyond one’s own microeconomics that entail the social and critical aspect of keeping the generations moving forward in a sustainable manner and the responsibility for the same rests with people like me. It also help me inculcate values like professional acumen, accuracy, presentation, public speaking, making presentations all of which have played a significant role in enhancing the confidence and preparedness to step into the real world professional scenario.

Some professors even went to the extent of sacrificing their own private time to devote extra classes for us and invite special guests just to enhance our knowledge and understanding of the concepts that were being taught to us. This also made me learn that putting one’s heart into training your subjects or juniors is the greatest help you can do which in turn might significantly shape up their future. It also struck the abstract inside in me to help people in general after experiencing the generosity of the professors as a first hand experience.

The end of course dissertation was a rich experience that taught me valuable lessons. The highlight of this study for me was time management, which was a struggle midway as the work seemed enormous and the difficulty of the nature of this kind of a study demanded a lot of dedication, patience and perseverance to finally achieve the goals of this dissertation study as well as the entire course ended this year. The next critical thing that I have learnt here is the use of existing literature to
build upon my own additions and derive more in depth conclusions and logical explanations related to my area of study. This is true for an overall aspect of professional success as well where I have to build upon existing best practices at the workspace and achieve the goals of the division. This would also help me contribute my own skills and newer additions to the team that would make our contribution more significant than it would have been without having made a study like this. The ability to derive conclusions based on derived evidences is also a valuable addition to my skills, as there was a point in my professional stint where I was making reports for the senior management without having the entire sense of purpose and understanding about the whereabouts of the utilisation of the facts and outcomes mentioned in the report. This will help me take decisions with a sense of confidence and logic that would enhance my contribution to my firm or business.

Lastly the most important aspect which I think I benefitted in was planning. I had been pretty weak in planning things according to a proper schedule and had always been around the deadlines for every submission. But this dissertation helped me plan things for a long period of time right from the submission of a research proposal in the first semester to the submission today. The period in between demanded short term deadlines, associations, meet ups, interaction with supervisors while at the same time ensuring that the study is relevant to the financial world and that stakeholders would benefit from the study in some way.
References


7. Appendices:

Appendix A: Cost and Profit Efficiency Scores:

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</tr>
<tr>
<td><strong>Profit Before Tax</strong></td>
<td>2162.246</td>
<td>2227.114</td>
<td>2506.636</td>
<td>2362.745</td>
<td>2293.927</td>
<td>2506.636</td>
<td>2581.835</td>
<td>2659.290</td>
<td>2739.069</td>
</tr>
<tr>
<td><strong>Q1 Total Loans</strong></td>
<td>3500.100</td>
<td>3605.103</td>
<td>4057.575</td>
<td>3824.654</td>
<td>3713.256</td>
<td>4057.575</td>
<td>3824.654</td>
<td>4304.682</td>
<td>4433.822</td>
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<tr>
<td><strong>Q2 Other Earning Assets</strong></td>
<td>3444.206</td>
<td>3547.532</td>
<td>3992.779</td>
<td>3763.577</td>
<td>3653.958</td>
<td>3992.779</td>
<td>4112.562</td>
<td>4235.939</td>
<td>4363.017</td>
</tr>
<tr>
<td><strong>Q3 Deposits</strong></td>
<td>3550.457</td>
<td>3667.271</td>
<td>4127.546</td>
<td>3890.608</td>
<td>3777.289</td>
<td>4127.546</td>
<td>3890.608</td>
<td>4378.913</td>
<td>4510.281</td>
</tr>
<tr>
<td><strong>P1 Cost of Borrowed Funds</strong></td>
<td>(0.955)</td>
<td>(0.984)</td>
<td>(1.044)</td>
<td>(1.044)</td>
<td>(1.014)</td>
<td>(1.044)</td>
<td>(1.141)</td>
<td>(1.175)</td>
<td>(1.210)</td>
</tr>
<tr>
<td><strong>P3 Cost of Labor</strong></td>
<td>(3.319)</td>
<td>(3.419)</td>
<td>(3.848)</td>
<td>(3.627)</td>
<td>(3.522)</td>
<td>(3.848)</td>
<td>(3.963)</td>
<td>(4.032)</td>
<td>(3.627)</td>
</tr>
<tr>
<td><strong>Equity</strong></td>
<td>2835.660</td>
<td>2920.636</td>
<td>3287.201</td>
<td>3592.014</td>
<td>3008.256</td>
<td>3287.201</td>
<td>3385.817</td>
<td>3487.302</td>
<td>3239.365</td>
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