

**CHARLES UNIVERSITY IN PRAGUE**

**FACULTY OF SOCIAL SCIENCES**

Institute of Economic Studies



## **The impact of Online Banking on Bank Performance**

*Master thesis*

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## Declaration of Authorship

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## Abstract

The performance of commercial banks is changing due to the technology improving day by day. The purpose of this study is to highlight the challenges that are derived from Adoption of online banking. The engage of the five European countries with a period of study from 1999 – 2010 to adoption of online banking is the core idea of this study. The empirical analysis would employ data obtained from 22 commercial banks from the following countries: United Kingdom, Germany, Czech Republic, Latvia, and Poland. We want to show that the adoption of online banking increase the bank performance indicator. With the application of the Instrumental Variable concludes that adoption of Online Banking is negatively related with three bank performance indicators as: Return on Equity (Roe), Return on Asset (Roa) and Margin (Mrg) as a main fault to global financial crisis.

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## Abbreviations

ROAA	Return on Average Assets
ROAE	Return on Average Equity
MRG	Margin
MSH	Market Share
OVR	Overhead Ratio
LA	Loan to Asset
DA	Deposit to Asset
Indtdumm	Internet banking dummy
Inter	Internet Usage
Tertiary	College
Secondary	Secondary School
IV	Instrumental Variable

# Master Thesis Proposal



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## **Proposed Topic:**

The impact of Online Banking on Bank Performance

## **Topic Characteristics:**

This study will try to explain the online banking challenges during its lifetime. Being a highly contemporary used practice, e-banking brings closer unique technologies which can affirm several transactions and revolutionize entire services. In major focus the study will provide theoretical and empirical arguments of online banking.

The history of online banking and its improvement. Reaction of online banking in economic and social aspects. The core approach of the study is whether online banking adoption is performing well to Return on Asset, Return on Equity and Margin.

## **Hypotheses:**

1. Internet Banking affects ROA positively
2. Internet Banking affects ROE positively
3. Internet Banking affects MRG positively

## **Methodology:**

I will collect data from the World Bank database, Bankscope, International Monetary Fund and International Financial Statistics, Peen World data, as well as from the webpage of different countries related to the online banking reports. The study will cover the period from 1999-2010 for 22 commercial banks. The methodology will be the same for the three hypotheses, as the main motive is to test how bank performance indicator result due to adoption of online banking adoption. Online Banking adoption will be used as a dummy variable, where if the adoption is present will be equal to one, and if the adoption is not present will be equal to zero. I will try to prove that the Online Banking adoption affects positively in Return on Asset, Return on Equity and Margin

## Outline:

- Introduction
- Online Banking
- Economic and Social Reaction
- Literature Review
- Data
- Empirical Results
- Conclusion

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# 1. Introduction

The affection of technology in business the past left as an uncompleted puzzle. The lack of its consideration evolved to a deeper impact in nowadays. Developments in technology touched also the bank department, giving birth to a new product called online banking or e-banking. What an online banking offers is an opportunity to perform different bank operations, where a customer can access his or her bank account via the Internet. Such operations can be performed at a variety of usage from personal computer to a mobile phone. Customers can check current account, saving account, transfer money and make their payments. Online banking usage is becoming very common due to the increase of usage of computers and mobiles which avail the transfers. Despite doubts at its first introduction, customers took time to adjust their activities to this technology. On the other hand, there were some uncertain thoughts whether online banking is seen more as a supplement rather than a substitute product. Nevertheless, the majority of banks nowadays are offering it and costumers most importantly find it useful. Online banking was initiated as a different way of banking and less expensive. In the customers' perspective, it meant less time to spend. The majority of costumers at the beginning were confronted with some difficulties but after a period it was very productive; whereas from the banks point of view at the beginning they had some expense and feared for a big loss. According to some studies, results for adoption of online banking generally would come after two or three years. In the literature review we will present the studies that provide theoretical and empirical analysis relating our study.

After the third decade of the first online banking users in the USA, major studies followed policy implications, rules, laws and banks types. Luckily nowadays, studies took place also for the part of Europe and adopted with our specifics policy implication, types of banks, small, big, commercial, domestic, foreign and linking to the bank performance indicators. The purpose of this study is to summit for the online banking challenges from the product itself, to the economic and social reaction, in the Europe area and its rules.

This study is structured as follow: First chapter is containing the introduction of online banking. Chapter 2 is the literature review. Chapter 3 is devoted to online banking types, also treats

economic and social reactions of internet banking as inevitable aspects of its impact. Fourth chapter is the impact of global financial crisis to the adoption of online banking. Fifth chapter introduce the model, data and methodology. Results are in Chapter 6 and the Conclusion is found in chapter 7.

## 2. Literature Review

In this chapter we will provide with profound research dealing with the online banking adoption and their empirical analysis. We will emphasize the most important and relative ones to our study.

The paper of Ceylan, Emre, Ash Deniz (2008) analyzes the internet banking performance in Turkey. During a period of time from 1996 to the year 2000 it took in consideration 14 commercial and savings bank. The authors have used ROE (return on equity), ROA (return on asset) and MARGIN as a performance variable. The analysis concluded that in the first year of adoption usually there is no positive performance; it takes two or three years to reach a good performance. The results show that the ROE has a positive result in the second year of adoption. There is also positive result for ROA, but the variable is not significant.

The study of Husni Ali and Noor Mousa (2011) evaluates the performance of Jordanian domestic banks by adopting e-banking services. The study was based on three types of banks: non internet services, recent adopters of the e-banking services and early adopters of these services. The ratios used in the study included Return on Assets, Return on Equity and Margin of Interest as profitability ratio. The study covered a period of time from the year 2000 to 2009. On the basis of empirical analysis all the bank types of the study, which differed in e-banking adoption were compared on the basis of the performance as a measure. Results for the non-internet services had no significant effect on ROE, but they were significant in terms of ROA. For the second type the recent adopters of the services for a period less than 2 years, the significance was only on Margin. The last type of the bank that applied electronic banking services it did not have any significance on banks profitability for the whole period of time. In this case it is clearly seen that it takes time to be adapted to the e-banking services, as for every new product usually it takes two or three years to see the positive result.

There is another similar empirical analysis in India by Pooja and Balwinder (2009). Authors choose 85 commercial banks, some public and private ones for a period of time from 1998 to the year 2006. The study is divided in univariate and multivariate analysis, using 10 financial performances. The authors wanted to prove the performance and risk in relation to online banking. In the univariate analysis the hypothesis is built on how the online and non online

banking adoption performs on the basis of those 10 financial indicators. Due to the Size results that Internet banking is bigger in assets and employees. The profitability, operating efficiency and financing Internet banks perform better with a lower cost. In the category of Asset Quality and Diversification again internet banks are having a lower net Non Performing Assets (NPA). Lastly, in the category Cost of Operation it is implied that Internet banking usually is expected to have lower cost of operation. This conclusion is sustained by the authors by proving that private banks have lower costs, whereas public and early adopters have higher costs, which can be attributed to the used costs in maintaining physical branches or adopting the online banking. The second part of analysis is developed to prove if there is a connection between offering internet banking to performance and risk, using OLS estimation and dependent variable such as ROE, ROA, and NPA. It concludes that in terms of ROE and ROA there is no significance between the Internet and performance. However, there is negative significance between the Internet and ROA in the part of private banks and its sub category. Another result highlighted is that in term of ROE the internet banking performance was very good and reached 10 percent significance at foreign banks. The last dependent variable NPA in this study had great result, such as the Internet is not increasing risk, but it is actually decreasing the risk profile. This was the second analysis which proved that Internet banking is getting better and better through time and is performed in a good way.

Özataç and Nwobodo (2010) studied the internet banking in Northern Cyprus at a period of time 2004-2009, in a panel data of 22 retail banking. They also used ROE and ROA as dependent variables. In this case, two other ratios were included: the CA- ratio of total credit to total assets and the CD-ratio of total credit to total deposits used to test the link between Internet banking and performance. The model resulted with a low link between the variable and the absence of multicollinearity among variable. The main conclusion was that the CA and CD ratios, both resulted with negative relationship while using the internet. Despite the internet banking increases the performance in different sectors, the authors entail that in case of these two ratios they were not used wisely or properly.

Josiah and Nancy (2012) in their study intend to confirm if there is a relationship between e-banking and performance by using Pearson Product- Moment Correlation Coefficient test. They focused in a regression with ROA as dependent variable, EB (investment in electronic banking

measured in Kshs) as independent variable, CDS (number of debit/cards issued by banks) and ATMS (number of systems installed by banks). The purpose was analyzing the impact of e-banking, on bank performance. Usually other studies involved research on the relation of loan, deposit and other variables, but Josiah and Nancy (2012) used different variables. They started with 43 commercial banks, from which only 27 banks answered positively to the data sent to the managers. Basically, the study was based on these 27 commercial banks for a period of time from 2006 to 2007 year. Conclusion resulted that E-banking has strong significance on ROA in the banking industry of Kenya. The relationship between e-banking and performance of banks was positive. Overall the whole study concluded that the adoption has made good points, especially the use of debit cards and ATM made the costumer access to the money for 24/7.

The comparative analysis by Francesca and Peter (2008) represent a good study because its evaluation is done in four different European countries like Spain, UK, Finland and Italy. The authors aim to embrace not only if there is a performance and internet banking service relation, but also checking if there were differences or similarities in mixed banks that use online banking, and pure online banking ones. Fuzzy cluster analysis was used to show the difference into the bank group in performance and other characteristic divide them into groups, as mixed bank of internet banking and they found out it is more trivial. The Panel data used was from 1995-2004 year with 46 banks. Fixed effect panel estimation as a reason of heterogeneity unobserved across banks with different states and dependent variable ROA and ROE. The authors found out that generally there is no such difference into pure online banking and mixed internet banking. From the loan perspective, pure online banking are not so keen into offering loans, whereas mixed bank is more into that. The findings included that internet banks performed well in term of ROA, ROE. As mentioned above, it is difficult to distinguish of pure and mixed internet banking. From the performance aspect, it could be specified by using some explanation of differences between some banks, and also adding the macroeconomic indicator and technology related to the ratios. It was observed an increase of the IT departments costs and personnel and the management of the banks were more oriented towards the online banking offering.

There are studies that deal with endogeneity due to the Internet Banking variable, as the basic combination that are made in the model some of them suspected that there is endogeneity and they use Instrumental Variable .



Another study by Onay and Ozsoz (2012) used a panel data in 18 deposit banks in Turkey, in a period of time from 1990-2008 in the emerging market centre. They wanted to test that internet adoption has a negative effect on profitability in the beginning of the adoption year, and the positive effect on the deposit and credit branch. In their model they are using some other basic variables as Interest Income, Non interest income, Branch profit, Branch deposit, Branch credit, Perno as a log of the number of personnel per branch and Internet as dummy. They suspected for endogeneity thus they used four exogenous variable for Internet dummy as: Large if the banks' asset are in the fourth quantile, State if the bank is government owned, Foreign if the bank is foreign owned , Listed if the bank is listed on the stock exchange. Their test was realized in 2SLS in a Probit model. The conclusion is that performance of banking sector in an emerging market is different as in emerging markets the adoption of Online banking reduces the bank's profitability. Another finding is that the internet adoption has a positive effect on branch profitability, in deposit and loans as that is the second prove that they tested. The main issue is that the market has its own limit or ability, as in emerging market it is more difficult to adopt and increase the performance while in developed markets is easy and more effective. That is why in an emerging market the physical network is still present.

According to Hernando and Niete (2006) they also used Instrumental Variable for Internet banking adoption dummy. Their study is done in 72 commercial banks of Spain from 1994 till 2000. They aim first to prove that internet banking adoption, reduce the overhead expenses and the cost reduction results the increase of profitability's bank. The model is using the same variable as other study, but here we have two equation first want to know the effect on performance variables and second they use branch's performance due to online banking adoption. Instrumental Variables for Internet dummy are e seven exogenous variables as (HOUSEHOLD, URBAN, FINANCIAL\_GROUP, LARGE, LISTED). The same Instrumental Variable is used for the second model. In the model without Instrumental Variable they see that adoption of Online Banking is having a positive effect in terms of ROA and ROE also there is a lower staff cost significant after a half year of adoption in both estimation. But with the Instrumental Variable there seems to give more complete information as the expenditure is significantly decreasing over a period of 12 months or one year. There is evidence of efficiency improvement in general expenses in the first model, while the second model seems to increase the number of

branches due to adoption of online banking in the first six months as it imply that internet adoption is more complementary issue and not fully substitute for physical branches.

Authors DeYoung, Lang and Nolle (2007) study provide another empirical analysis by using Instrumental Variable. The interest is to show that banks that adopted transactional Internet web sites is more as a complement rather as substitute to classic bank. They want to show how this adoption affected the financial performance of banks from 1999-2001 to the 5175 branching banks, and 5599 commercial banks as of 1999 is the year that mostly adoption of online banking started also the authors find appropriate to start with this year. Their study is done only in community banks with assets less than 1 billion dollars as a reason that banks with higher income already have been adopting the product. By adding the Internet to physical bank branches, they show no such results as a higher increase in profitability as expected, but some small increase in non-interest income. Another issue in this study is that they mention that fixed overhead can be reduced by adopting web sites in comparison with branches, it also can affect that employees get higher wages due to 24 hour call centre to assist website user. In the empirical part they indicate two questions: Where the Internet-adopting banks different? And Did Internet adoption affects bank performance? The answer to the first question show that the Internet adopting banks differ by some characteristic as market structure, market demographics, macroeconomics condition, and bank size. Apparently the Internet banks due to Roe was more profitable than the brick and mortar banks, and also more welcome in local markets with younger and well educated population. While the bank performance results show that with the help of Instrumental Variable as: College, Senior, Rival and Mutual Funds as they doubt on endogeneity in their model and got better results. In final am that the retail and business customers are more known with the Internet banking now than in the past and bank use as a substitute due to customers' need, but for the physical branches are more a going together rather than substitutes.

The study by Lambrecht and Seim (2006) is done in German banks and analyses the consumers adoption and usage of online banking from August 2001 till July 2003, study demonstrate in detail also the relationship between Internet availability and channel choice and also the effect of channel usage on costumer level and revenue inference of online banking. The data are gathered from retail banking to 55602 individual holders. Authors want to know whether the adoption of online banking and usage is different and why, is it because of age, income, education or whether

the branch existence in the area where people live. As they suspect for potential endogeneity on consumer usage that is independent of intensity of consumer usage. So authors use three instruments. The result implies that number of transaction and logins among costumers that use service is low, but is conditional on usage. The study gives more detail in empirical part, but the final conclusion is that: authors find the divergence between customer adoption in online banking whether consumers adopt and when they adopt online banking. Also the online banking adoption is very much related to educated people, with higher income and mostly male. The other fact is that older costumer and higher income people they use online banking the most because of their complete financial situation and seem to show a higher rate of using banking services. The most important part is the revenue as is assumed to get lower, but it depends in this study due to product differences. According to the study, they also emphasize that except the marketing of online banking as a product the most important part is also the brief information for costumers to know how to use as it implicated some problem to costumer while getting and idea of using it.

### 3. Online banking

In this chapter we will present the basic history of online banking, the primary type and its progress. Apart from that we will arise the economic and social effect due to Online Banking adoption and compare with different countries by their difference and alike.

#### History of Online banking

Online banking first appeared in 1980 when it was understood as a terminal, keyboard and TV to access the banking system by using a phone line. Chase Manhattan, Chemical, Citibank, and Manufacturers Hanover were the four big banks that provided home banking service by a Videotext system. Even though that it did not take long time to adopt this system because of the commercial failure of Videotex all this went off. In France the use of Videotext or (Minitel) was given by the telecom provider, whereas in the UK, with the use of Prestel system. But the first home service online banking was implemented by Bank of Scotland for customers of the Nottingham Building Society (NBS) in 1983. They used the same system as UK Prestel with a computer, as the BBC Micro, keyboard (TANDATA Td1 400) that connected to a telephone system and television set the system named "HOMELINK". Customers were allowed to take a look at their statements, bank transfers and bill payments. This is just a brief history where all started, and not to forget that this was three decades before, and now Online Banking became very popular, important and mostly a substitute for customers everyday life.

#### Types of Online Banking

Online banking types evolved from their beginnings. The types of online banking that are used mostly are: ATM, PC Banking, Phone Banking, and Email Banking.

#### ATM-Automated Teller Machine

The basic form of non branch bank is the ATM (Automated teller machine) is a type of banking where customers can access with their card and pin and check their balances, withdraw money,

and make payment. This type of banking is a small machine that can be found in banks, and all around the city depending from the usage rate.

The study by Angeli, Coventry and Johnson (2003) is based on Hoffstede cultural dimension to the adoption of ATM. According to their data it confirms that in 2002 there were 27000 ATM in UK and there was a raise for 50 percent for the previous year, every day people withdraw 300 million pounds. As the first type of non branching bank its usage, it began slowly but increased in the time being that in USA 60 percent of youth were ATM users. It is true to say that in 2014 for people the ATM is simply presumed as a box machine that you withdraw money and finish the procedure. It took almost thirty years of hard working and promotion to make it functional and very usable through the time. ATM nowadays is also present everywhere and usage is still present, but mostly in rural area, where the costumer withdraws money during the night, even that the risk of withdrawing money during the night is too high and people try to avoid it but some feel secure and use the ATM.

### Personal Computer Banking

PC Banking is the second most used one after Phone Banking. With the increasing number of laptop and PC users, online banking represents an easy way to access by passwords and user names. Different forms are met varying from country to country: having a license file on the basis of which the customer uploads in the computer and it assures his access in the bank webpage with a user name and password. The other way is by having a so called Token, a small device liable to a USB containing six-digit numbers which change each minute and the customer may use the token numbers as a password. The other form is from the webpage of banks by putting the user name and password to continue the operations.

## Phone Banking and Mobile Banking

Categorized as two different types, phone banking and mobile banking belong to the classic and modern developments of the phone. Phone Banking was the first type of banking, customers used to call the banks and with some preliminary question of making sure that the caller was the owner of the account, they could ask for the current balance, make payment, and transfer. While nowadays the mobile phone is a more effective one, because it is the customer himself that makes the operations. It is getting very usable and applicable everywhere nowadays; also costumers seem to feel more secure with this type. It is similar to PC Banking but on a smaller machine, as well as it is a 24/7 operation through which the customer can pay, transfer and check balances everywhere, every time.

## Email Banking

It represents a type of banking that operates with the customers by sending and receiving emails. By sending email to the bank, the customer informs about the operations he would like to undertake, whereas the bank replies to questions. The final part is concluded by the confirmation of payments and other specified operations by email between the parties. Email banking could include the use of the customer's PC or Mobile, where in both cases the conclusion of the operation is accompanied by a confirmation.

European Banking Federation (2010) report shows that number of ATM in European Union were increasing to 434000 at the end of 2009, that means a 22 percent increase since 2004 or 1200 inhabitants per ATM where the least number of inhabitants per ATM were registered in the Czech Republic, Sweden and Poland, where the number are between 2400 and 2900 inhabitants per device. Here they include the number of electronic money as part of online banking, mobile, email, internet banking, within EU-27 in 2009 we're experiencing a huge number of transactions to 913 million, compared to 2004 that is 2.7 times more, by all means 1700 transaction per minute of every hour , overall in 2009 there was 21 billion euro purchase online.

Oracle (2013) is a paper that presents the idea of mobile banking, how it evolved during the time and how today is becoming more usable mobile banking type. The mobile device has now achieved to run through the system just with a smart card integrated in mobile. Whether is safe or not remains to be seen, but for sure it is integrated into people's lives and they can transfer money from mobile to mobile through the so called electronic wallet, they can pay coffee just with a card, etc. Their study shows that in a world with a 7 billion people living, 5 billion have mobile phones and 2 billion have bank accounts. It is absolutely natural that coins will become just a vintage type of payment and electronic payment will become a command.

## Pros and Cons of Online banking

This part is dedicated to the pros and cons of online banking that banks and customers were confronted to admit and get a hold.

Bander and Charles (2006) pronounce that the benefit of Online Banking for banks is cost savings, for customers is practicality. Pros of Online banking involve: less time consuming, faster action and the ability to make banking operation for 24/7. In Finland, for instance, the customers had to face long distances and spend time and energy to reach the bank offices. Instead of these past being present personally at the bank offices, online banking turned out to be a benefit for the customers. Moreover, faster actions are reflected in making payment, checking balances, book flying tickets or order online shopping.

Authors Al-Hawari, Hartley and Ward (2005) analyses the quality of bank automated services. Where the Internet Banking has some key characteristic as: Availability of information, Easy to use, Secure, Error free transactions, Attractive web site, Attractive website, Website interface accuracy and Up to date information.<sup>1</sup> The other pro for the banks part is cost reduction, avoiding long waiting lines and decreasing the number of workers. These characteristics transpire a success in comparison to the higher costs of expense due to the increase of the IT employees in previous times. Yet, this study sustained that the positive result of online banking usually would

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<sup>1</sup> “ Measuring Banks’ Automated Service Quality: A Confirmatory Factor Analysis Approach “ (2005)

come after two or three years after its implementation. On the other hand, the cons have to be modified during the period.

The other study from Gensler, Leeflanc and Skiera (2011) main concern in their paper was to prove why customer should find it appropriate to use online banking. It was because it increases the customer revenues and decreases the costs to serve, as indicated two point bonus for customer. The study gives a very high importance to this issue; according to the empirical part they find out that customer that uses online banking have higher revenues. They intend to get more aware of the importance of the online products and use it more and the revenues get higher, while the cost to serve is lower and they avoid using the branch, and customer pay for the service get lower.

The other matter is the confirmation that the customer becomes a manager of their own account, though in the past the possibility to know the movement of saving and current account was scarce, now is not a subject anymore. The opportunity to manage your account and circulate your own money the way you want is present now. Not to forget that the customer is the best critic when it comes to the performance of a new bank product and also encourages the improvement and makes it easy to use.

The basic cons of online banking are secure, mail malware, attack of the PC, or mobile phone stealing. According to Mansumittrchai and Chiu (2012) their study was based on adopter and non adopters of internet banking. Both categories of adopters and non adopters resulted concerned about the security and privacy of their bank information. The adopters were likely to take the risks of hacked pin and knowing that the money may be hacked out from their account. Mail malware represents the most frustrating situation for the customer, since they may appear as offer for any bank product, with lower rates, or loans offer or other non-banking product and require the personal data like name and card number. Precautions are not opening doubtful emails and protecting the mobiles from persons who may get into the customer's account.

Where Koskosas (2011) show the pros of online banking, he points out four other interesting cons of online banking as: bank relationship that no matter the easiness to use online banking, there is still the customer need that gives small opportunity to get as in the case of loan, then also solving the problem of the fee getting better service, than the businesses accounts that usually



want to expand the capital or need some extra service. The transaction is one of a kind that costumers sometime get very irritated, the fee from one bank to another bank in different country is very high, and as a result this is another minus that maybe by meeting face to face they will get some relief by this fee or at least lower fee. Service issue also has a great value, because banks usually offer some special services to preferred costumers such as rates for saving account, and less charging for some specific products. The last one is security that is a major concern to costumers, even that laws and regulation exist still technology is unpredictable, and there are costumers that become a victim of unwanted activity that threat their accounts.

## Economic and Social Reactions

Launched three decades ago, online banking service has been connected to the fast technological and scientific innovations. Modern practical online techniques allow customers to profit from these services all the time. As a service it is accompanied by the economic and social reaction. The development of technology has increased peoples' awareness of embracing the latest quality of service, so this could be considered a positive effect in a society, making customers' life easier, for a short of time and effective. Moreover, the economy would be provided by all means good quality and great growth. From the bank's perspective the online banking in the beginning increases expenses, but it would pay off and result positive for the company after some time. Several studies showed that it took usually two or three years to see a positive result. Firstly the number of branches decreased the number of employees also and the usage of online banking increased. Secondly, it helps employees to profit their wages and paying bills or debts online at a 24/7 service facility.

Online banking influences in decreasing the corruption and money laundry are as present as in the classic way. Rules defining bank transfers keep the confidentiality of the money amount, name and pin data. In this context, security in these operations represents another economic effect. Moreover, online banking service displays the marketing development, especially in online buying portals like Amazon and E-bay. The business offers have been adapted to the online banking changes and this interconnection of technology innovations; online banking transfers have stimulated the customers demand for product and services worldwide.

Another influence is that online banking opens new possibilities to make an economic agreement between countries, stimulating trade of products and services by involving countries to transfer money from one state to another. This could imply to some benefit agreements as transaction cost could be lower and the relationship between countries can grow year by year bringing more mutual profits.

Additionally, the using of online banking stimulates people to buy Personal Computer and mobiles. In general, it has a positive result on the economic aspect.

According to the “Information Economy Report (2007-2008)” by the UNCTAD secretariat there are some statistics and theoretical evidence that proves that using Information Communication Technology (ICT) had influenced the countries in economic aspect very much. The usage of E-banking or online banking and e-payment for the retail and corporate concluded that it was less expensive for commercial bank and very convenient for household, government and businesses. Asymmetric information as a basic problem in financial markets seems to diminish through time as well. In the case of getting a job, having an online banking account would imply that pension funds, private equity, and insurance companies will be supported in managing more money flow. Progress of the technology helped also in the decrease of money pocket, which result in less robbing or stealing. It is very usual today to see people that have less cash money in their pocket, everything they pay either by card, by phone, or through a PC. It makes people more aware that is more secure and practical. The circulation of cash money is going to decrease while the electronic money is being more usable.

The social reaction symbolizes a most delicate aspect of the online banking. On the basis of sex, age, education, probably there would be different reactions apparently between men and female relating online banking. In common, men depending from their education and income accepted online banking more easily than women did, because they were more reliable customers. This resulted, according to Yuen (2013) who studied gender and age acceptance in USA and Malaysia. Author pointed out that despite the great number of studies of gender and online banking acceptance relation, they would not consider the cultural factor. His study was based on a questionnaire on which customers were asked in their last six months online banking operations. Characteristics that made female and male differ in using online banking were ranked as social influence, effort, performance and behavior. Social influence in the USA resulted much

more present than in Malaysia, because young people usually are willing to try something new rather than in Malaysia. Moreover, Malaysian women are more willing to use online banking than in the USA, because they want to finish all financial obligations quickly and spend more time with the family. The study showed that in the USA young people are more reliable in an Online banking in comparison to Malaysia despite the higher age effect in Malaysia. In the USA it was given more importance to the effort, performance and behavior of the customers, and men resorted to adapt very well in using online banking at their spare time.

The study of Nor, Pearson and Ahmad (2010) emphasize the innovation diffusion theory (IDT) that touches the idea of why people are willing to adopt the new technology. Authors have been based on five key beliefs: relative advantage, complexity, compatibility, trial ability and observability. Author's collected data by surveying 1164 businesses and MBA students, they used structural equation. By five hypotheses the authors want to prove why people attend to use Online Banking, with the help of five key beliefs they found out that relative advantage, compatibility and trial ability influence the person's position in Internet Banking. The authors bring up that the banks work has to be done in part of marketing related to technology and its payback as Internet Banking that is faster, suitable for transaction and less money to pay for it.

The study by Dennis, Tamira and Abdullah (2011) showed that gender issue affected on online banking using. The study involved comparisons of the United Kingdom and Kingdom of Saudi Arabia on the basis of 532 questionnaires. It appears that they wanted to prove that men use more online banking than women, because they are more easy adapted and more willing than women. Men according to the authors were keener into online banking because of online banking performing financial actions, investments and saving money. Overall the study concluded that in KSA there are more undergraduate students who used online banking (from which men 171, while in UK 134). Additionally, the women usage was 227 in KSA, while surprisingly in UK 150, because of two countries' cultural differences. KSA was more willing to use online banking and generally men use more Online Banking than women from the gender perspective.

Another study done in Finland by Mattila, Karjaluoto , Pento (2003), provided more information of the age factor in relation to the use of online banking. Despite the assumption that the high range of group using online banking was from 25 -35 years old, the paper ascertained another view. According to it, the mature customer market is usually at the age of 65 years old. The

authors pointed out that in Finland, after twenty years every four persons will be in the age of 65 years old. So the main issue was providing extra information to older people on using the online banking. Despite the old aging Finnish society, older customers have businesses and possess money. Therefore, bankers would have strategies to include not only young people, but also them and the bank profits might increase.

Education is a major characteristic which would impact using online banking. Studies based on undergraduate students showed that young people are more willing into using online banking. With a better education comes a better well paid job, therefore these increase the online banking involvement. All the payments are oriented towards the online banking, workshops, tickets and retail goods and other services. Well educated people represent the most probable online banking customer group.

## Countries

In this study, we are using data for empirical analysis on five countries: United Kingdom, Germany, Poland, Latvia, and the Czech Republic. Initially, it is important to give a brief introduction to these countries in the perspective of the Online Banking adoption rate. As most of the papers studied previously examined the different regions like USA, Asia and Africa, my purpose was to focus on the Europe's adoption rate to the online banking. This is why all the countries chosen for the empirical analysis are European.

## United Kingdom

In the history of Online Banking there is a brief introduction of states that first offered Online Banking. United Kingdom was one of the first in 1980 that offered this service "Homelink" by the Nottingham Building Society and Scotland Bank but it was not efficient at that time. Elizabeth (1999) was one of the studies done in the UK and Ireland. The questionnaires included basic data from banks and several organizations that implement online banking. There were 25 responses to questionnaires from which 88 percent were based in the United Kingdom and 12 percent in Ireland as well as 68 percent were banks and 32 percent building societies. The 88

percent of the representing United Kingdom, where overall PC banking reached 44 percent, Internet service overall reached the 50 percent level from the summing up in 40 percent of the UK. In 1999 the adoption rate was going up for United Kingdom and it was proved and it really increased very much. Last fact mentioned was that in the same year it was pointed out that with 62 percent of respondents relating the online banking offer today they would use approximately 5 percent of them. In the end it was concluded that from the comparison of UK and Ireland, resulted that UK banks intend to widespread online banking and their adoption rate.

Additionally, the 2009 research done by Rita, Andrea and Daniel, indicated the factors of Internet banking adoption in some countries and in the UK. It showed that over a decade, there is a slight increase of usage, even though the main issue is the fraud loss. In 2007 fraud loss reached 67% where the phishing incident increased to 42% stressing the security problems of online banking.

## Poland

The paper from Polasik and Wisniewski (2008) emphasized the empirical analysis of the decision to adopt online banking in Poland. Data collecting was done by questionnaires to 3519 people who used the internet. Except the personal will to adopt online banking in Poland there was some state issue that prevented the rate of adoption. In terms of Information and Telecommunication Technology (ICT) Poland was way behind the western countries at the time of 80's. Because of these factors: broadband in rural area was very limited, also their low education and missing information about the distribution channels until 90's the wide spread of online banking did not take place. It was important that from 1993 till 1998 there was a process of privatization that open door of the foreign bank to invest reaching in 2006 to the 60.5 per cent of foreigner ownership. First automated teller machine established in 1990 by Bank Pekao S.A, 23 years later in comparison to the United Kingdom. Citibank Poland S.A launched the first PC-banking product in 1992, and the increase of PC-banking in the corporate segment was 100 thousand installations in 2004. After the foreign technology influence, online banking evolved. PC-banking was the most important electronic channel used in Poland that implied 20 per cent of the number and 70 per cent of the electronic transfer. In October 1998 the internet banking

service was offered by Powszechny Bank Gospodarczy S.A and in the year 2000 Bank Rozwoju Esportu S.A launched mBank reaching in the year 2006 the number of 21 banks. Hypothesis used in empirical analysis are: perceived security, internet experience, marketing exposure, use of other banking products, type of internet connection, demographic characteristic. These factors motivate people to use online banking. Conclusions show that security plays a major role. The more secure is online banking, the more customers prefer to use online banking. Another factor is the internet experience, basic knowledge of using internet avail customers to profit more from online banking services. Lastly, the demographic characteristics like age, gender and education play a major role in online banking.

## Latvia

The study of Kaže , Baumanė, Šumilo, Škapars (2007) confirm that Online banking in Latvia developed by the banking department and the telecommunication technology that having a rapid growth from 1999 year. Internet and telecommunication technology offered new modern channels which have been improved for online banking. The most used E-service are Internet banks, Phone banks, tele-banks, m-banking and TV-banking. Latvia experienced the Internet growth starting from 4% of economically active residents in 1995 to 70% in the year 2004. Internet banking would be the most used types of E-service with 1.6 million mobile users in 2005 which will affect the increase of using m-banking. Therefore, Latvia would not show any decrease or lower usage of Internet banking and the usage of Online Banking will increase further.

## Germany

According to Deutsche Bank Research the main problem of online banking analysis is the lack of data in different countries. Stobbe (2002) gave very clear data for online banking in Germany, highlighting in 2002 a range of 11 to 16 million people using online banking. The main concern was that the slow speed of internet and the high fees while doing online banking. Nevertheless, as it was previously forecasted, the number increased to 30 million banking users in 2006.

German customers focus more on security of the online banking. The report from Dapp (2012) where age and population characteristics are evaluated, it was forecasted that the online usage will reach to 44 million people by 2030 year. Moreover, the age 24-30 years old remains a concern since in 2060 it is assumed that 30 percent of the population will be 65 years old. On the other hand, data showed clearly that in 2011 year, 69 percent of people who profited from online banking and marketing service were between ages 25 to 44 years old. The share of older people using online banking it is expected to rise by 15 percent more; nevertheless the German customers still experience security issue as a factor in Internet banking

## Czech Republic

The study of Stryckova (2012) on the case of the Czech Republic the online banking adoption does not seem to very complex, even that the study shows more from the point of technology. Surprisingly, it does not emphasize the difficulties of customer to adopt with the new product. The first virtual banking in Czech Republic is launched in 2007 as the study implies. In the recent years the electronic banking in Czech Republic arrived at the highest point the type of online banking that they offer and use as : Internet Banking, Home Banking, Phone Banking, Wap-Banking , PDA Banking and Mobile Banking. In 2012 there is 18 percent of banks that offer mobile phone banking, that includes 44 Czech banks the Home banking is 20 percent at 44 Czech Banks also. The population usage of Online Banking from 2005 was 5 percent of population, in 2006 was 9 percent till 2010 it increased usually by 2 percent, and in 2010 it was 22 per cent of the population used online banking. In 2012, 30 percent of the population was using Internet Banking. The main reason of the slow increasing is also the Internet offering in the full area, because in 2006 the internet was available only to 29 per cent of households while in 2010 it increased to 60 percent of household been offered Internet. So actually it was going in parallel level due to the internet offering and online banking. It is important to state that the type of online banking offered in the Czech Republic during the last decade, it really showed the determination of improving the offer types, as SMS messaging, GSM banking, Java banking and other application for smart phones as I Phone, Android, and Blackberry.

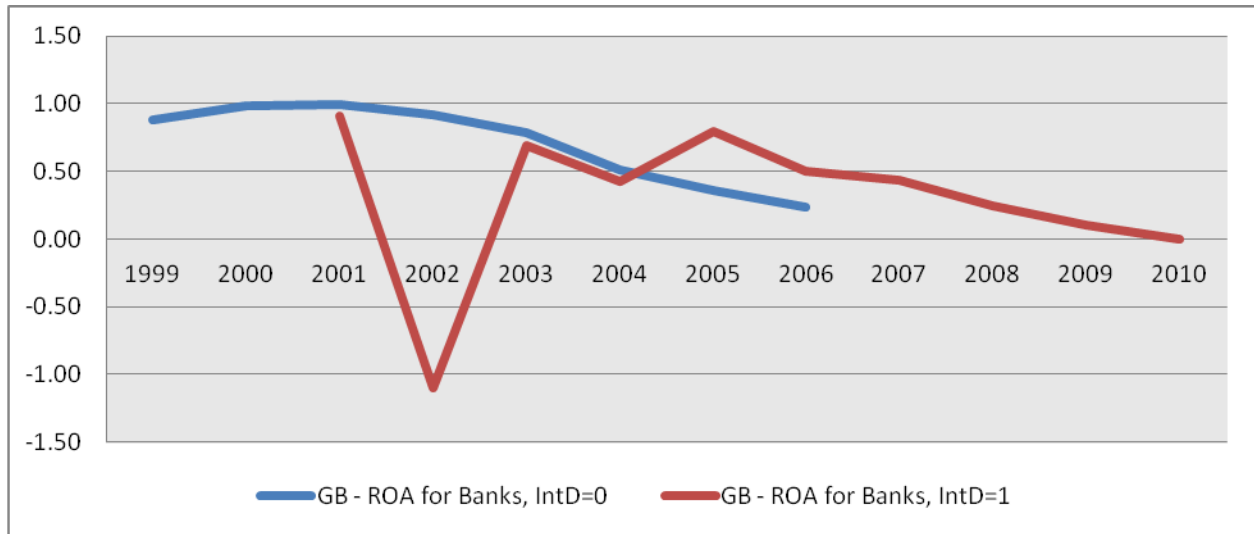
## 4. Global financial crisis owing the bad performance of online banking

We deeply believe that global financial crisis has the most fault in the bad performance of online banking. Most of banks adoption was launched from 2003 or 2004 and the awaited of god results bond when the global financial crisis started in 2007. Here we demonstrate with diagrams as we made some computation in excel by showing how the ROA, ROE and MRG is increasing or decreasing with the adoption of Online Banking that is the red line and without Online Banking that is blue line. We will embrace all the countries separately by showing how the global crisis has also impact the bad performance of online banking.

### **United Kingdom**

The red line represents the Internet adoption, in case of Great Britain we can see that banks from 2001 to beginning of 2003 there is a negative ROA. It could be caused by social issues, unemployment; also the 11 September could really attack the banks in matters of business agreement. The peak is at mid of 2003 and goes again down and from 2004 till 2005 there is a great increase of ROA in terms of banks adopting online banking which could be the adjust of the new product or the unemployment and social might calm. The sharp decrease is from 2006 obviously from crisis but is not negative as from 2001, still it may affected very well , we see that in 2010 the ROA is in line with 0.00 ROA at least is not negative and may improve.

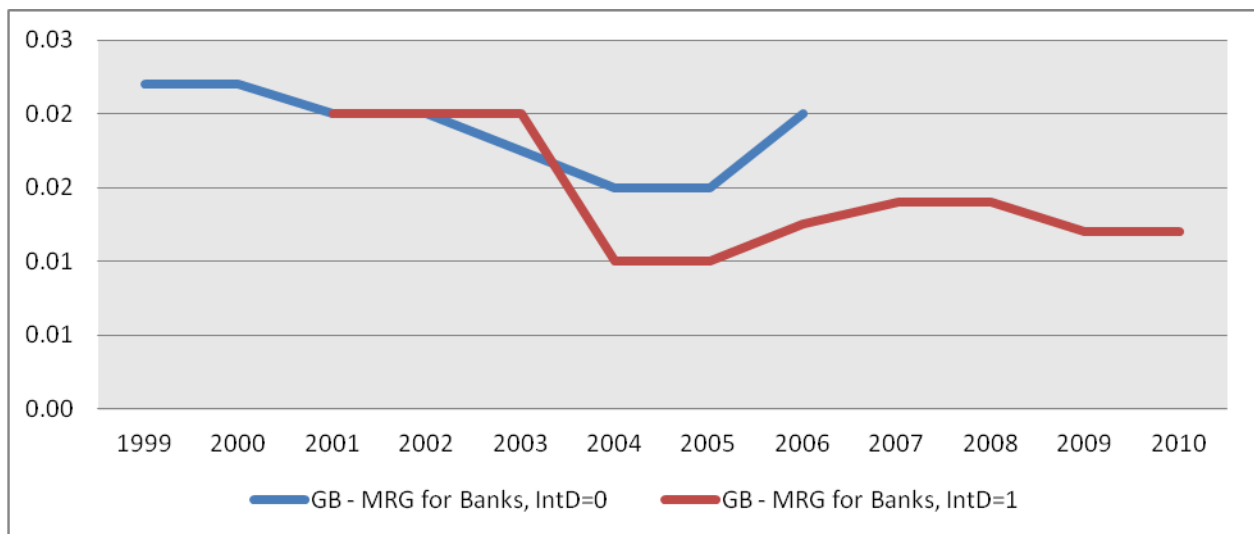




**Figure 1 GB - ROA for Banks, IntD=0 , IntD=1**

*Source: Author computation*

The MRG is slightly different with the exception of the year 2003, and then from 2006 seem to have a step by step increase, and get better from 2009 from the value of 0.01 to 0.02.

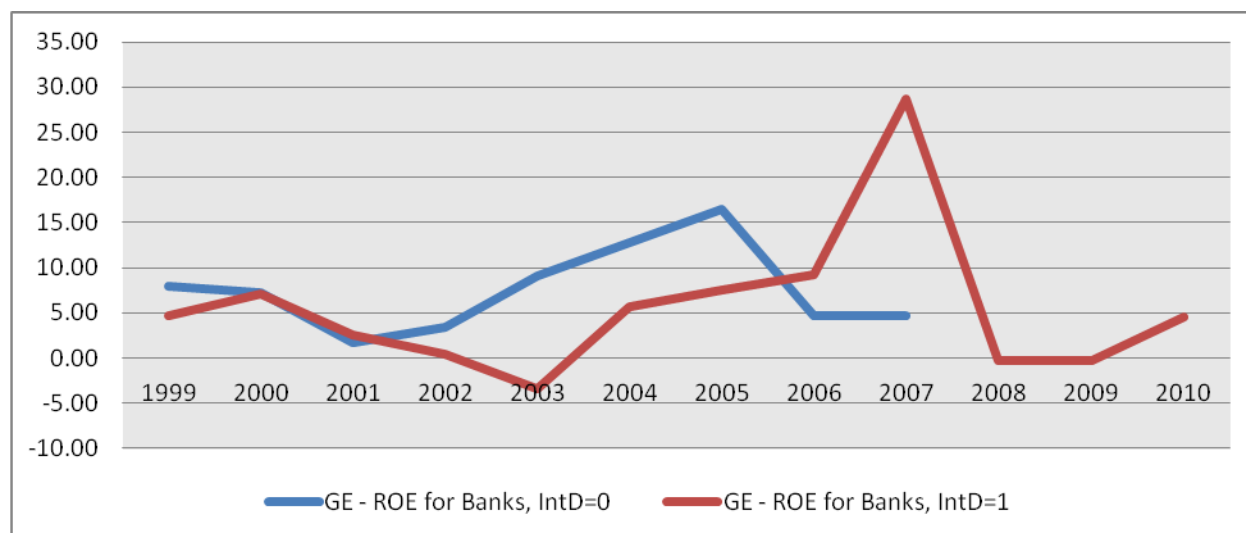


**Figure 2 GB - ROE for Banks, IntD=0, IntD=1**

*Source: Author computation*

ROE the second performance indicator of banks does not follow the same track as ROA. The negative ROE remains the same, but from 2007 seems to increase.

Additionally, from 2009 there is a sharp decrease as it might be the wake up crisis later.



**Figure 3 GB - MRG for Banks, IntD=0, IntD=1**

*Source: Author computation*

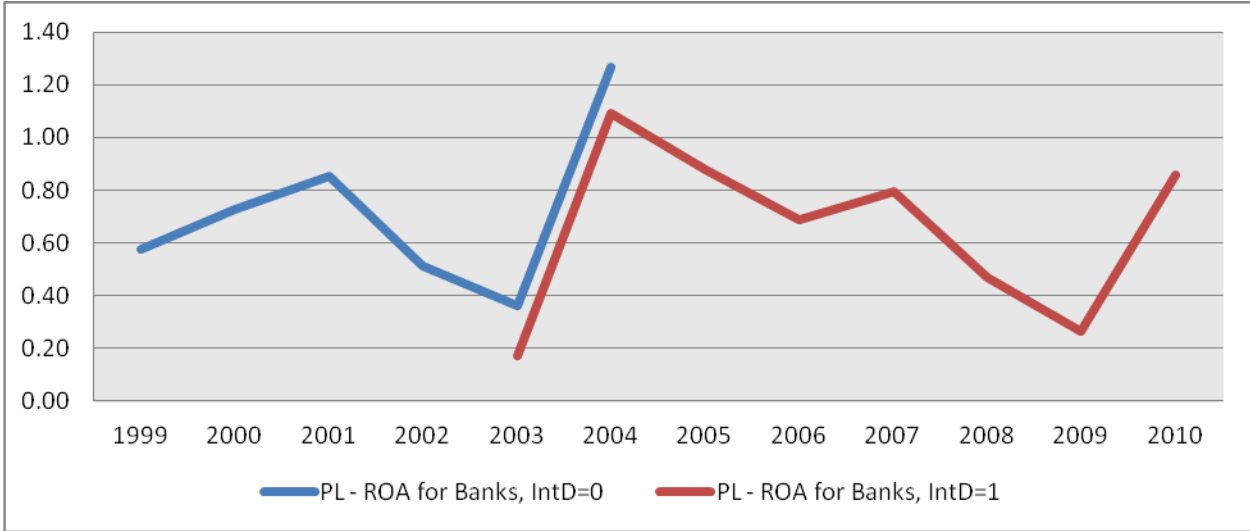
Except the figures that show the link of online banking and bank indicator performance, it is assumed that the global financial crisis was much more sneaky and consequences got deeper. Here we will enlighten the studies that were done during the global financial crisis and the bad performance indicator in each country.

Hardie and Maxfield (2010) compare how the global financial crisis between the US and UK. The main deal was the commercial bank in the UK were more market oriented than in the US and the expose dig up to the debt. Also the exchange rate from dollar to pound, it confirmed with a big loss for UK. Lending issue was much more in the UK rather in the US, and jointly made the UK weaker during the period of financial crisis. Wholesale borrowing in the UK was 4 trillion dollars at the end of 2007 compared to US. Beside the foreign currency repos exceeded to 500 billion pounds in 2007 where was named as unsecured borrowing wasted.

Deutsche bank research (2013) frozes the facts that the UK was more exposed to financial crisis due to the international banks that made a bad bridge in the context of financial indicator performance. United Kingdom is a well known cross border that makes investors, international banks, and foreign institution to do the business, but at the other side, it did not help in the case of global financial crisis as the expose was too elevated and shocking for the banks and the country itself.

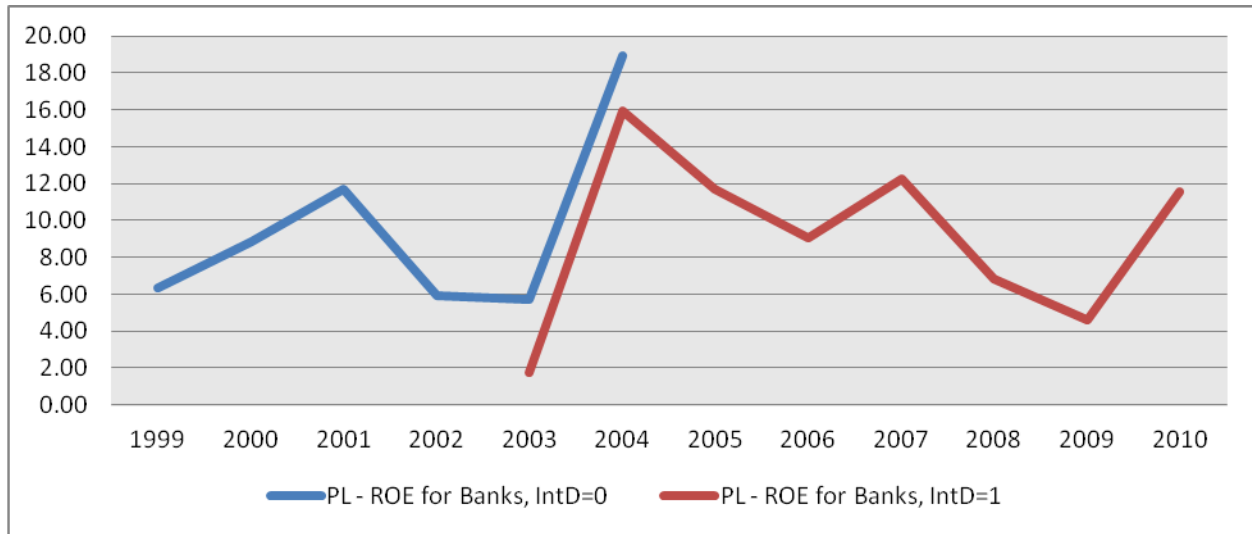
**Poland**

Poland has a better ROA apart from 2003 when banks adopted mostly online banking with a slight increase, which could be seen that from 2004 till 2005 there was a slight shift down. In the same year Poland was accepted in the European Union ,thus, the struggle to get a higher performance could be seen as a potential reason. From 2007 till 2008 is declining due to crisis and from 2009 there is an improvement.



**Figure 4 PL - ROA for Banks, IntD=0, IntD=1**

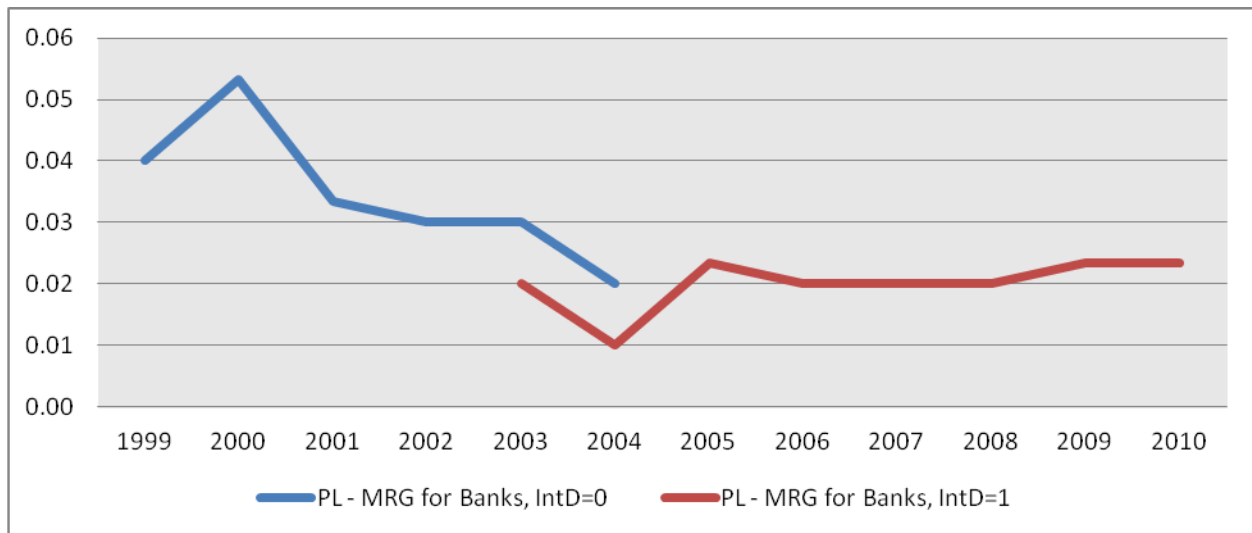
*Source: Author computations*



**Figure 5 PL - ROE for Banks, IntD=0, IntD=1**

*Source: Author computations*

The same matter implies also for ROE as they are related also the change in the market and the new opportunity has placed in this case.



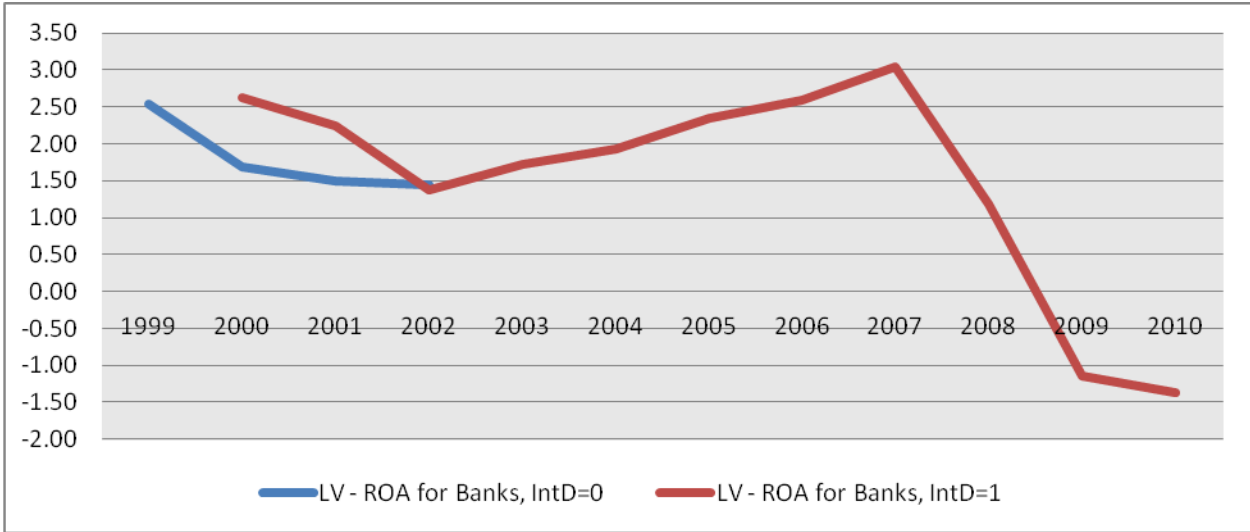
**Figure 6 PL - MRG for Banks, IntD=0, IntD=1**

*Source: Author computations*

The margin is a different matter the difference between interests appears to decrease at the beginning of 2003 and increase from 2004, while from 2005 keeps the constant ratio of 0.02. The crisis either did not affect or the most change happened to ROE and ROA.

Study from Pawlowska (2012) is showing more the competition of banks where it includes the crisis and integration in the Euro Zone and the merger affection of crisis. Author mentions that first Poland had to deal with the independence of domestic banks only, while the integration in Euro Zone came also with the investment of the euro zone countries is visible that the crisis came along with it. With all the changes as implementation in technology that achieved a great performance of Internet Banking as it spots the main improvement. Not to forget that in 2009 in Poland there were 39 commercial banks invested by foreigners. From 2002 to 2007 there was a slow down consolidation and also started the global financial crisis, as is mentioned in the study that from 2008 to 2009 due to financial condition the bank's performance was weak and challenging. Also here the ROA, ROE and NIM changed abruptly.

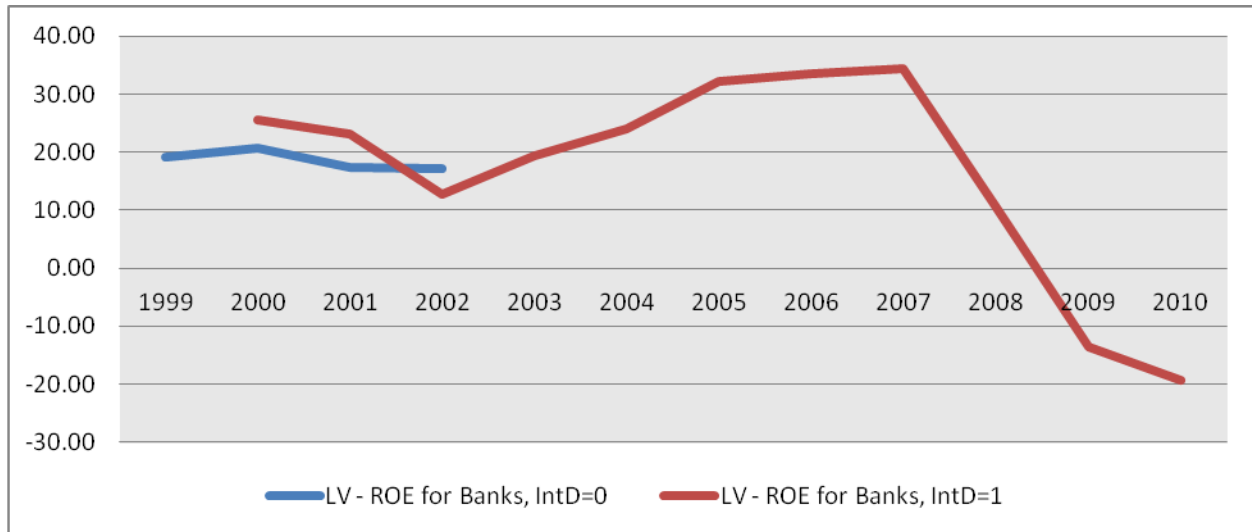
**Latvia**



**Figure 7 LV - ROA for Banks, IntD=0, IntD=1**

*Source: Author computations*

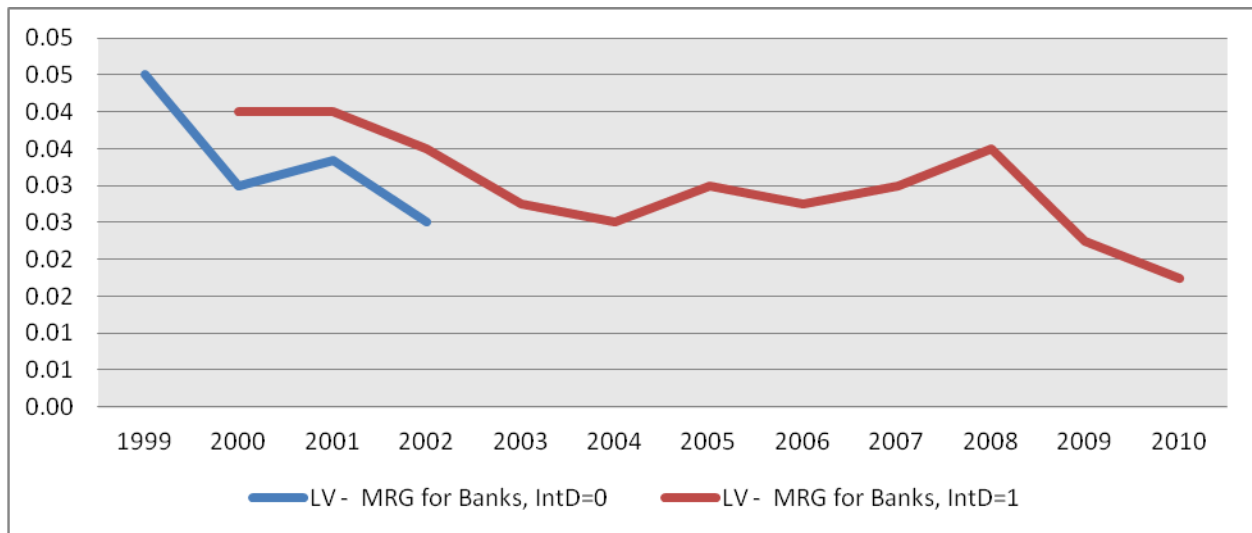
Of the two countries above, we saw that ROA and ROE were mostly going on the same trail of increase and decline, so in Latvian case we see that from 2002 till 2004 there was a coherent increase of the banks that adopted online banking, it includes three year test where after that online banking has to show better results.



**Figure 8 LV - ROE for Banks, IntD=0, IntD=1**

*Source: Author computation*

From 2005 to 2007 the ROA is at 3.00, but after that the crisis affects so much that at the beginning of 2009 it becomes negative, also for the ROE after 2007 is a negative number. According to the global crisis, Latvia appears to have the worst performance ever. It affected the economy, the wage which relates to the banks and also unemployment.



**Figure 9 LV - MRG for Banks, IntD=0, IntD=1**

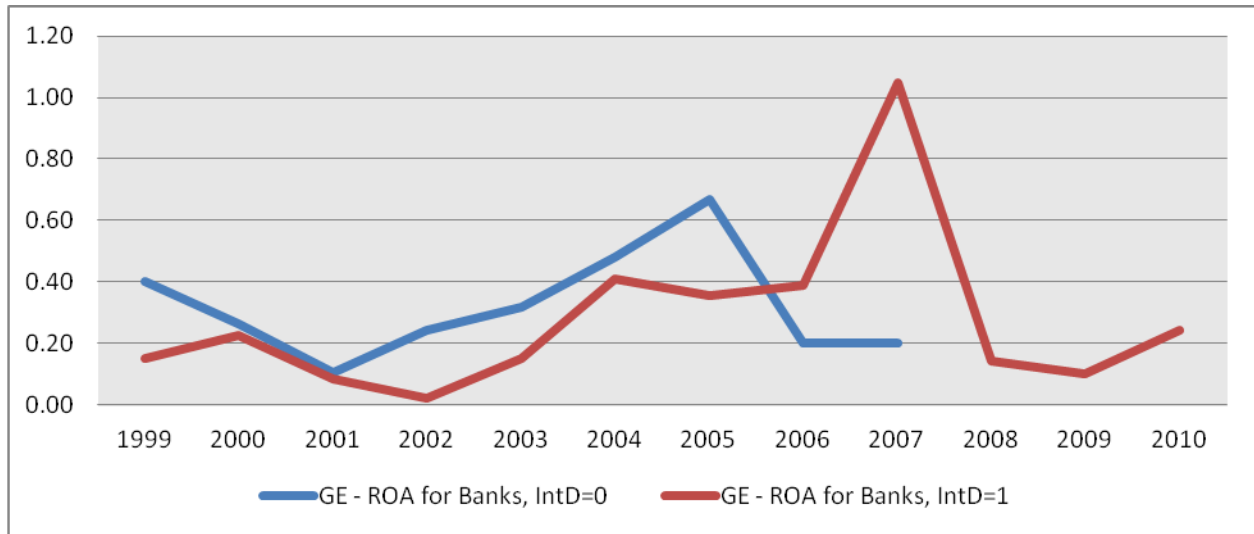
*Source: Author Computation*

In the case of Margin there is no high decrease or increase simply it follow up and down from 2004 till 2007, after that is a decrease but not tremendously significant.

According to Saksonova and Solovjova (2011) for Latvian commercial banks there was no rescue from the crisis. In 1999 the commercial banks had to deal with the end of Russian crisis affect in assets. I mention above that the countries are close to each other and also during the period of study, they either entered into a European group of FMN and also were touched by the crisis. Also the idea that most of the banks in Latvia are foreigners and the crisis pass around easier and influence more. Aside from the crisis in Latvia they also count the macroeconomic reason as the loss in 2009 were about 773421 million levels and 53500 LVL in 2010 is due to possible macroeconomic factors which relate to commercial banks, and the main decrease due to crisis in 2008 they lost 1616 million LVL where that accounts for 7 % of total asset in commercial banks. In this study there are two big banks that are also part of our empirical study the SEB BANK and Rietumu bank where based on the rating is written that in 1999 the bad loans and this can also explain the figure above. In 2009 the SEB banks had to deal with the bad ratings of asset quality where relates to asset to total loans while Rietumu bank was not so bad. The Return on asset (Roa) from 2001 and 2010 show that from 2003 there is a slight decrease on all commercial banks in Latvia from 0.27 where it goes to a negative number from 2004 to -3.51 but it improves in 2005 to better negative number -1.65. Latvia entered the European Union in 2004 where the foreign investment impacted to the commercial banking system as the inhabitants started to take the credits. Crisis also touched the credit portfolio with a high decrease 1160 million levels and 2009 to 1095 million LVL, where the revenues in Latvian commercial banks increased from 2004 till 2007 and when the crisis entered it arrived to the edge.

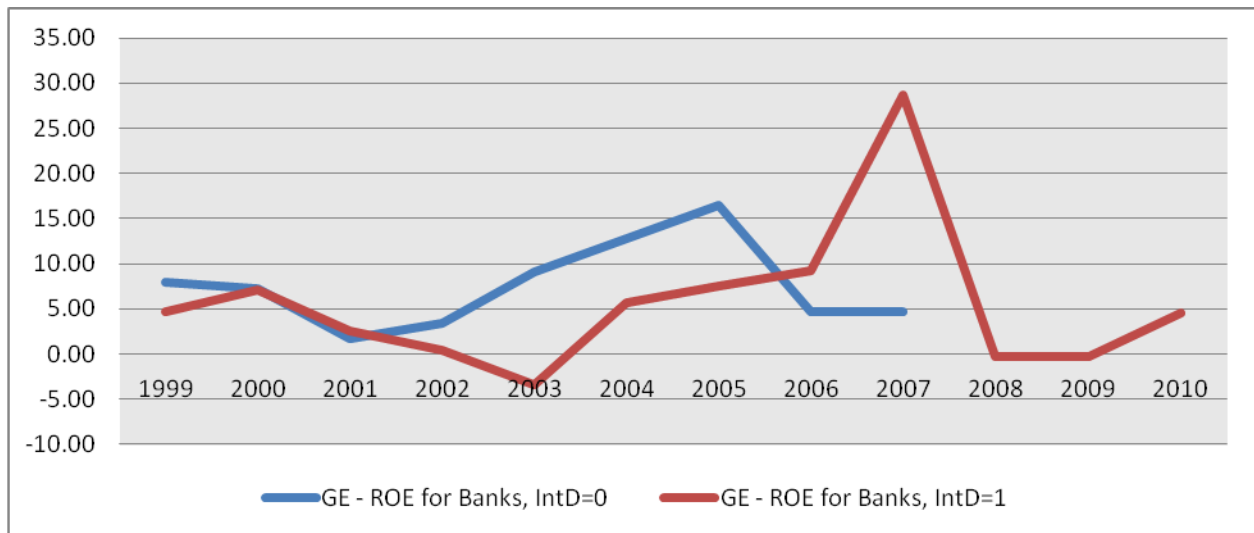
## **Germany**

In Germany we know that adoption of online has begun since 1999 where our study starts, there are well known banks that they already were launching this product. In the Figure 10 from 2002 till 2004 there is an increase, but from 2004 to 2006 is simply stay at the ratio of 0.40 below the 1 ratio. From 2007 till 2009 there we see a huge decrease due to crisis as the banks are well known and also the global crisis seem to reduce the ROA and ROE also.



**Figure 10 GE- ROA for Banks, IntD=0, IntD=1**

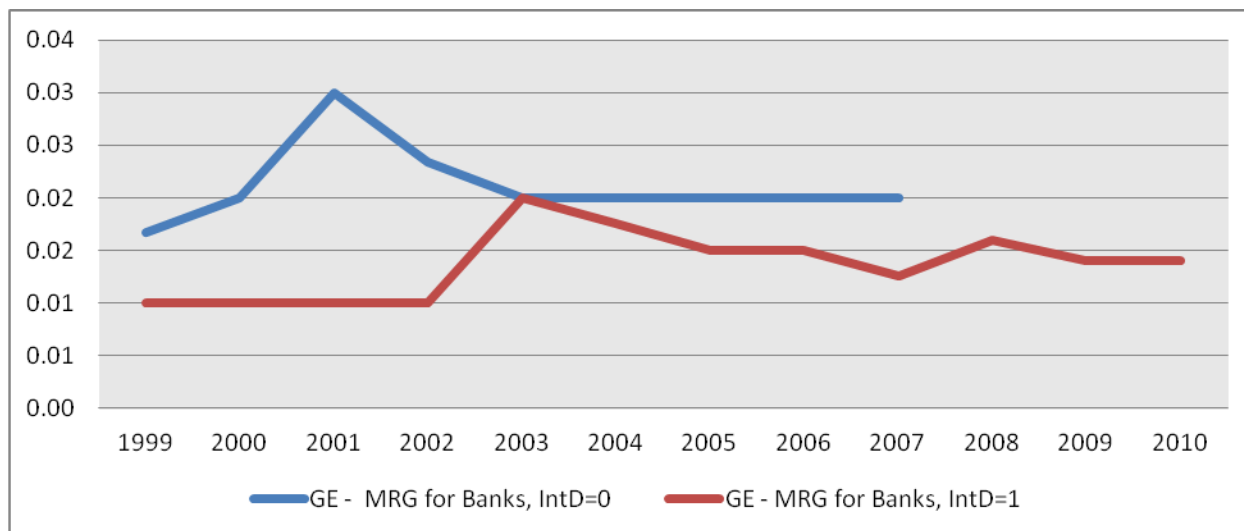
*Source: Author computation*



**Figure 11 GE- ROE for Banks, IntD=0, IntD=1**

*Source: Author Computation*





**Figure 12 GR- MRG for Banks, IntD=0, IntD=1**

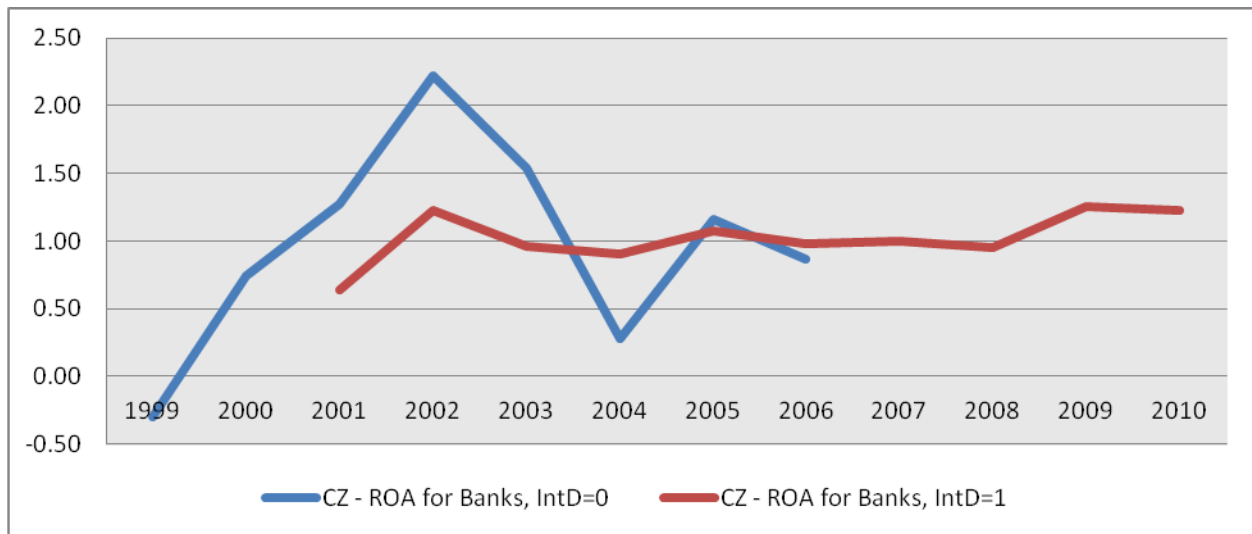
*Source: Author computation*

The margin does not have the same implication as ROA and ROE, there is an increase from 2002 till 2003, and then it goes down slowly and keeps changing with normal volatility. The crisis does not seem to affect very much a slight decrease but then after 2008 and the end of period is in better performance.

Studies that relate the financial crisis in the case of Germany seem to start way before than 2007. Germany as a best lender in the case of Asian and Russian crisis, they result that ROA and ROE could be the most issue that performed not well. According to International monetary fund (2011) entail that during the financial crisis in 2007 the German banks were hit very hard, but the help of government as a good way to help the banks was with the taxpayers' money. Where the federal government gave a rescue package of 480 billion euro as a first aid, and also other funds were given where in 2010 in Germany the stabilization took place. The ROE was mostly lower for the cooperative banks during the crisis; the large banks have no change at all. In our case it gives a great impression to this study while it highlights that in the case of Internet Banking the grown was rapid and even came to a level what competed with Sparkassen and cooperative banks. In another case it was inevitable that financial crisis hit the most commercial banks then cooperate banks, but in 2010 everything came to normal.

## Czech Republic

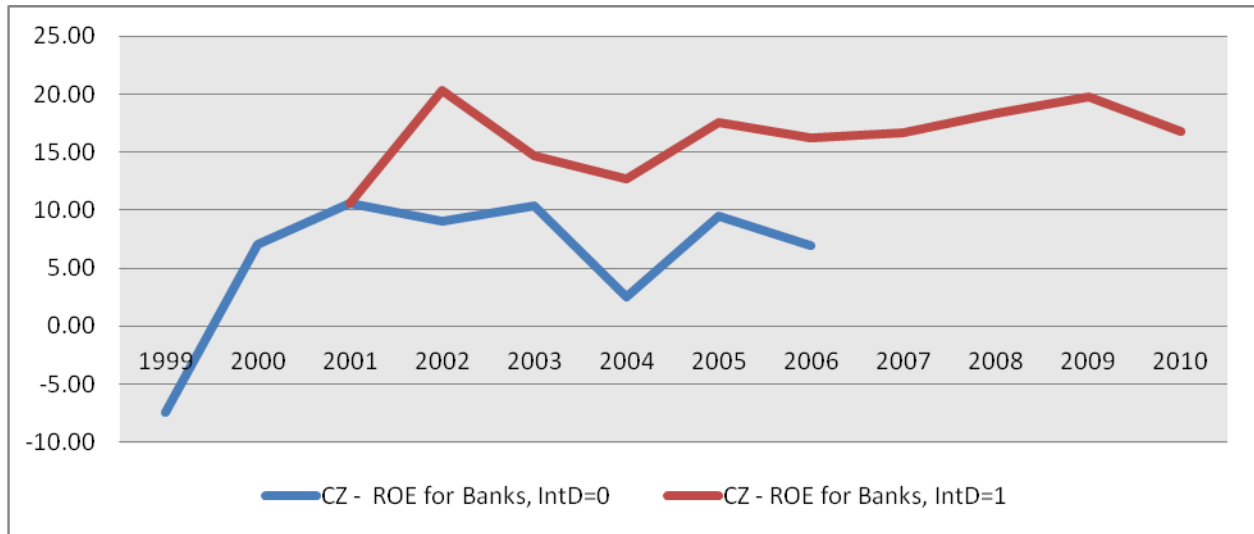
Czech Republic adoption of online banking from the figures down, we see that it started from 2001, apparently the banks with no online banking seem to have better ROA to 2.00 ratio and from 2003 it has sharp decrease. From 2003 till 2008 the ROA has mostly the same ratio, while surprisingly, from 2008 it has a decrease as in other countries from 2007 had sharp down. In Czech Republic's case, perhaps the financial crisis was not so present, or maybe that they had their own currency and the business with the outside was not so much.



**Figure 13 CZ- ROA for Banks, IntD=0, IntD=1**

*Source: Author Computation*

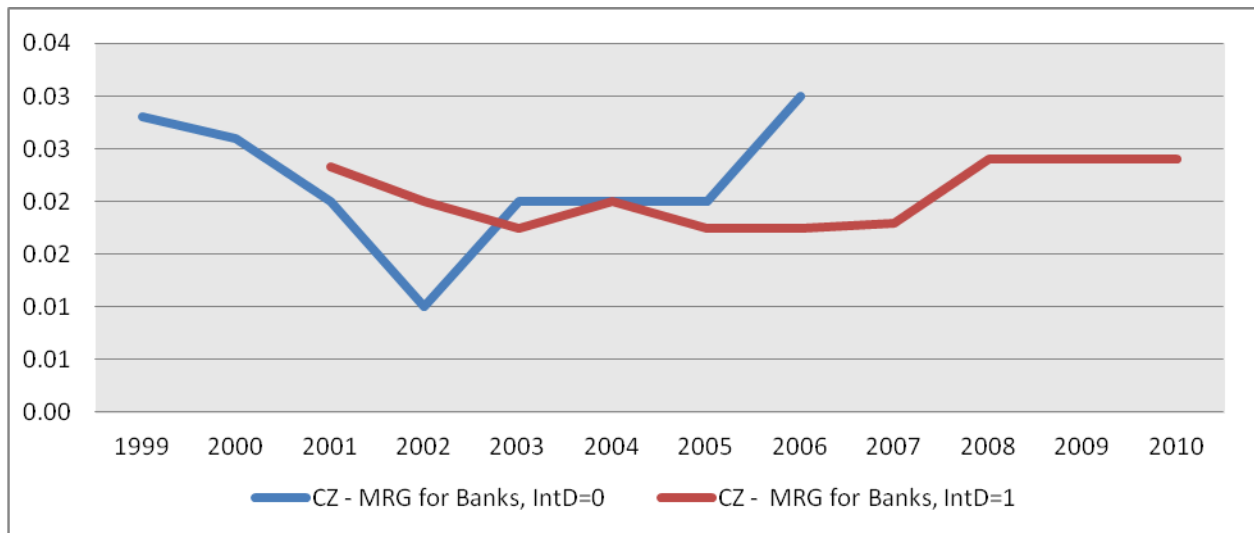
In Figure 14, the ROE is way much better than ROA, eventually the banks in the case of ROE did not have so much trouble with the crisis. It is obvious that from 2006 there it increases to the red line till 2009, where we see a decrease that is either late respond to crisis or bank issue.



**Figure 14 CZ- ROE for Banks, IntD=0, IntD=1**

*Source: Author Computation*

The margin as in another states are slightly different from the two other bank performance, the figure down it is surprisingly how the banks without adoption increased at the point of 0.03 ratio, and the banks with adoption from 2007 till 2008 are down but then are eventually getting better at value 0.02.



**Figure 15 CZ- MRG for Banks, IntD=0, IntD=1**

*Source: Author computation*

Last but not least is the Czech Republic that achieved to survive from the global financial crisis the most comparing to other countries. World Bank Report (2012) proves that even that in the European countries was struggling with the profound crisis in the Czech Republic was very severe or not so present that proves with the Return on Equity with a percentage of 26.4 and Return on Asset at 1.5 percent. It is very strange that even that most of the banks are foreign owned still the crisis did not take place. As of 2007 and 2009 the cross border interbank lending was beyond the borrowing. The household had a very special case of taking loans as they did not take loans in foreign currency and this proof that bank regulation made it clear and also protected their own currency and failing. The nonperforming loan to total loans in 2009 was 4.9 percent were in Slovakia, Hungary and Poland was better that is merely the only disadvantage, but during the crisis the cost to income ratio was under 40 percent in 2009. It is very clear that Czech Republic took lessons from the crisis in the past in 1990 and very tight in the case of last global financial crisis in 2007 and the Czech National Bank was very persistent into the policy that banks should follow and did not feel the era of the global financial crisis so much.

Except the social reaction and policies of different countries due to adoption of online banking, there is present the global financial crisis that usually stroke the banks significantly. The banks in study are usually older than two decades, some might change the operation, and others got better. From the figures we saw that crisis has the main fault in this case, all the five countries are either part of the European Union or Euro Zone, which demonstrates the financial crisis potentiality affecting the economies.

## 5. Model, Data and Methodology

The study is focused from 1999 to 2010, considering a period of 12 years on the basis of twenty-two active commercial banks. The study considers five European countries as the United Kingdom, Germany, Czech Republic, Latvia and Poland. Data are collected from four sources. They were taken from Fitch's database Bankscope Bureau Van Dijk for banks performance variables. In order to examine the online banking adoption data are collected by searching in each bank balance sheet and for the Instrumental Variable (IV) for Tertiary (University), Secondary school it was taken from Peen World Table. Lastly, for Job Growth Instrumental Variable and Internet usage the data were gathered from World Bank data.

Our model is based on the study of Al-Sa'di and Khwarish (2011) which was a development of Demirguc and Huizinga (1999) and by Athanasoglou, (2008), and by Aburime, (2008). Their model is :

$$Y_{it} = \alpha_0 + \alpha_1 \text{MACRO}_t + \sum \beta_i X_{it} + \alpha_{it} \text{INTERNET}^j_{it} + \varepsilon_{it}$$

The  $Y_{it}$  – is defined for bank performance,

$\text{MACRO}_t$  - stands for the lending rate in year t

$X_{it}$  - is a matrix of bank specific control variables (total deposits in a bank i as a ratio of total assets in year t, and others)

$\text{INTERNET}^j$  – represents the dummy variable matrix based on the time of e-banking adoption

In order to express our empirical study we made some changes in the model

$$\text{ROA}_{it} = \beta_1 \text{L\_A}_{it} + \beta_2 \text{D\_A}_{it} + \beta_3 \text{MSH}_{it} + \beta_{4o} \text{OVR}_{it} + \beta_5 \text{EFF}_{it} + \beta_6 \text{Intdumm}_{it}$$

$$\text{ROE}_{it} = \beta_1 \text{L\_A}_{it} + \beta_2 \text{D\_A}_{it} + \beta_3 \text{MSH}_{it} + \beta_{4o} \text{OVR}_{it} + \beta_5 \text{EFF}_{it} + \beta_6 \text{Intdumm}_{it}$$

$$\text{MRG}_{it} = \beta_1 \text{L\_A}_{it} + \beta_2 \text{D\_A}_{it} + \beta_3 \text{MSH}_{it} + \beta_{4o} \text{OVR}_{it} + \beta_5 \text{EFF}_{it} + \beta_6 \text{Intdumm}_{it}$$

The dependent variable ROE, ROA and MRG are bank performance indicator, where  $i$  is for the bank and  $t$  is for the time. The independent variable are  $L_A$  (loan to asset),  $D_A$  (deposit to asset),  $OVR$  (overhead ratio),  $Msh$  (market share),  $EFF$  (efficiency ratio) and  $Intdumm$  as a dummy variable that is =0 for non adoption and =1 for adoption.

### **Dependent variables**

ROE shows how much profit a bank earned compared to the total amount of shareholders' equity. It is one of the ratios that give information on how strong the bank is.

ROA is the second bank performance indicator it also shows the net income divided by total asset. It shows the effective way of bank using total assets that generate net income.

Margin or Net Interest Margin is a third important indicator of a bank's performance. It is the difference of net interest revenue from bank asset and the expenses by paying its liabilities.

### **Independent variables**

Loan to asset =  $\text{loan}/\text{asset}$  is the ratio that can change during the adoption of online banking. As the study says the credit risk is the highest risk that can affect the profitability of the bank.

Deposit to asset =  $\text{deposit}/\text{asset}$  is another ratio that is expected to change due to online banking, because nowadays banks that are more independent try to adopt new products.

Overhead ratio is a measure of expense such as for rent, maintenance. This is the ratio that every bank tries to get in lower numbers. In this case serves also as a good measure, where in the first and second year of adoption this ratio mostly is high.

Market shares another ratio that banks intend to reach the highest numbers. It shows that the performance and efficiency of the bank are better with the highest market share and also indirectly should increase during the adoption of online banking as it gets more affirmative.

Efficiency ratio:  $\text{Noninterest expense, less the amortization expense of intangible assets, as a percent of the sum of net interest income and noninterest income.}^2$  This variable is very

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<sup>2</sup> "Banking" on the Internet: Does Internet Banking Really Improve Bank Performance? (2011)

important as it is assumed that during the adoption of online banking the efficiency ratio would better be lower than higher.

The Internet is the dummy variable, it takes the value: Intdumm=0 if the Online banking is not adopted and Intdumm=1 if the Online banking is adopted.

## Panel Data

Our data set is the combination of different characteristics for a period of time in different countries. So time-series and cross-sectional data define the panel data. According to Baltagi we control for individual heterogeneity, because if we don't study this effect then the result will be biased. In our study, we are using panel data, and we will give a brief introduction. A panel is a set of observations on individuals, collected over time.<sup>3</sup> Our study is very common with the panel data because we are testing the characteristic of banks over a time period. The basic framework is:

$$y = x'it\beta + z'i\alpha + \varepsilon it =$$

$$= x'it\beta + \alpha_i + \varepsilon it$$

This framework explains that there are K regressors in  $X_{it}$  with no constant term. The  $z'i\alpha$  is the individual effect where the  $z_i$  contain the constant term and a set of individual, that may be observed and unobserved and all are taken to be constant over time  $t$ .<sup>4</sup>

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<sup>3</sup> Bruce Hansen "Econometrics" (2012)

<sup>4</sup> GREEN

## Pooled OLS

It is very basic process that we use when we have a panel data, all we do is we pool data and estimate OLS regression. So relating to the basic framework above we say that if  $z_i$  has a constant term, OLS is consistent and efficient estimate of  $\alpha$  and the slope vector  $\beta$ . Green (2012)

$$Y_{it} = \beta_0 + \beta_1 X_{it} + u_{it}$$

## Breusch and Pagan test

We use Breusch and Pagan test to see whether to use OLS or random effect model. Breusch and Pagan (1980) formulate the Lagrange Multiplier that test the random effect model on the OLS residuals.

Where the hypothesis are:

$$H_0: \sigma_\alpha^2 = 0 \quad \text{or} \quad (\text{Corr} [\eta_{it}, \eta_{is}] = 0)$$

$$H_1: \sigma_\alpha^2 \neq 0$$

Where the Null hypothesis is the limiting distribution of LM is chi-squared with one degree of freedom.

Test statistics

$$LM = \frac{NT}{2(T-1)} \left[ \frac{\sum_N (\sum_T e_{it})^2}{\sum_N \sum_T e_{it}} - 1 \right]^2$$

Here the  $e_{it}$  are the residuals from pooled OLS estimation of the model.

## Fixed Effects Model

The Fixed Effect model is usually used when want to know the impact of variable that vary over the time. In the case when the  $z_i$  is unobserved and correlated with  $x_{it}$ , then the least square estimator of  $\beta$  is biased and inconsistent as a result of omitted variable.



So the model:  $y_{it} = x_{it}\beta + a_i + e_{it}$ ,

The  $a_i$ 's show all the observed effects and represent an estimable conditional mean. In the fixed effect model the  $a_i$  is a group-specific constant term.

## Random Effect

We mention that in the fixed effects the  $Z_{it}$  is unobserved and correlated with  $X_{it}$ . In Random Effects the unobserved individual, is un-correlated with the included variable that is the opposite of fixed effect than the model will be:

$$y_{it} = x_{it}\beta + E[z_i a] + \{z_i a - E[z_i a]\} + e_{it} = x_{it}\beta + a + u_i + e_{it},$$

We get a linear regression model with compound disturbances that could be consistent although inefficient, estimated by least squares. Also in random effects the  $u_i$  is a group specific random element alike to  $e_{it}$  but for each group there is a single draw that enters the regression identically in each period.

## Hausman Test

Hausman test is the test that evaluates which model fits the data well, fixed or random effects. To run the test there are two hypotheses that one of them must meet:

$$\text{Ho: } E(u/X) = 0$$

$$\text{Ha: } E(u/X) \neq 0$$

More specifically test whether the errors  $u_i$  is correlated with the regressors and null hypothesis is that they are not. So when we run the Hausman test we have the covariance matrix of the difference vector,  $[b - \beta]$ :

$$\text{Var}[b - \beta] = \text{Var}[b] + \text{Var}[\beta] - \text{Cov}[b, \beta] - \text{Cov}[\beta, b]. \quad (1)$$

Then we get the result shown the covariance of an efficient estimator with the difference from an inefficient estimator is zero:

$$\text{Cov}[(\mathbf{b} - \boldsymbol{\beta}), \boldsymbol{\beta}] = \text{Cov}[\mathbf{b}, \boldsymbol{\beta}] - \text{Var}[\boldsymbol{\beta}] = \mathbf{0}$$

**Or:**  $\text{Cov}[\mathbf{b}, \boldsymbol{\beta}] = \text{Var}[\boldsymbol{\beta}]$ .

Inserting this result in (1) produces the required covariance matrix for the test,

$$\text{Var}[\mathbf{b} - \boldsymbol{\beta}] = \text{Var}[\mathbf{b}] - \text{Var}[\boldsymbol{\beta}] = \boldsymbol{\Psi}$$

Where the chi-squared test is based on the Wald criterion:

$$\mathbf{W} = \mathbf{x}' [\mathbf{K} - \mathbf{1}] = [\mathbf{b} - \boldsymbol{\beta}]' \boldsymbol{\Psi}^{-1} [\mathbf{b} - \boldsymbol{\beta}].$$

Under the null hypothesis,  $\mathbf{W}$  has a limiting chi-squared distribution with  $(\mathbf{K} - 1)$  degrees of freedom.

## Endogeneity and Instrumental Variable

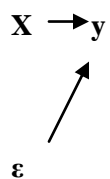
There are cases when we have endogeneity in our data. We have endogeneity in our data when we believe that the explanatory variable is correlated with error term, and then we say that we have endogeneity in our model.

The linear regression model is,

$$Y_i = x_i \beta + \varepsilon_i$$

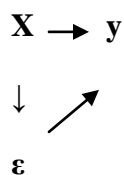
While we assume that  $x_i$  and  $\varepsilon_i$  are uncorrelated where  $E[\varepsilon_i | x_i] = 0$

Then we have exogeneity where between  $x_i$  and  $\varepsilon_i$  is no correlation



In the case when we have endogeneity where  $E[\varepsilon_i | x_i] \neq 0$

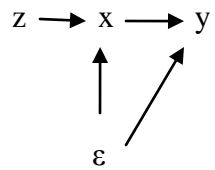
Then it looks like



To solve this problem we use Instrumental Variable that will help improve the results.

We always have to find a strong instrument otherwise we will not get better result.

With instrumental variable  $z$  it looks like:



The Instrumental variable  $z$  has to be uncorrelated with error term  $\varepsilon$  and correlated with explanatory variable  $x$ .

## 6. Results

Most of the empirical analyses are done usually on the most important bank performance indicators. In our study, we are having 264 observations, times –series length twelve years. On Kwarish and Al-Sa'di (2011) the basic model that we are based they test on three hypothesis as : test it in banks without e-banking, in recent adopters of e-banking and early adopter of e-banking. They tested only in the Jordanian banks and we wanted to expand to five European countries approximately 22 active commercial banks. In the empirical part they simply do the OLS estimation and find whether there is significant or not. Apart from that we checked one of the OLS assumption that is the error term has to be constant (Homoscedastic), otherwise if the error term is not constant then we are dealing with (Heteroskedasticity). For this we do the White test that proves whether there is a constant term or not.

We are having three hypotheses in which we will run all the tests in each of the hypothesis. We want to observe if the internet adoption in our case taken as a dummy variable for =1 if adopted and =0 if not, it has positive or negative result to ROA (Return on asset), ROE (Return on equity) and Margin (Net Interest Margin).

Comfort to the rules we do OLS estimation and we also check for (heteroskedasticity) so we do the White test by showing that the p-value is 0.072 and we have to point out that the main rule is if the p-value is 0.10 we have to use robust standard error, if it is lower we do not have to otherwise we will deal with wrong results and not definite.

In the first hypothesis the White test results show that p –value=0. 072273 were at the 1% significance level, we reject the Null Hypothesis: Homoskedastic and we use robust standard error. We use than pooled OLS with robust standard error and results are: The intercept is significant at1% level, the VRO (overhead) has also been significant at the 5% level at a high level where it would be the cost of adoption by decreasing ROA to 0.31 %. The MSH (market share) is very good in this case is increasing the ROA to 1.48% at the 10 % level of significant is good and is one of the variable that banks wants to have it in higher number. Loan, deposit and

the most important internet are not significant at all. Also the R-square shows that the data are fitting the model at 13%.

**Table 1 White test for ROA**

<b>ROA</b>
<b>White's test for heteroskedasticity</b>
<b>OLS, using 264 observations</b>
<b>Test statistic: <math>TR^2 = 37.162377</math>,</b>
<b>with p-value = <math>P(\text{Chi-square}(26) &gt; 37.162377) = 0.072273</math></b>

We do the same White test also for ROE and the result is with a p-value= 0.18046 and we do not reject the Null Hypothesis and we do not use robust standard error. We run Pooled OLS and the results are: the Da (deposit) is significant at the 1 % level and increase the ROE by 10.52 % , while the vr0 (overhead ratio) is also significant at the 1% ,but it decreases the ROE by 3.08 %, the msh (market share) is again significant at the 10% where it increases the ROE with 14.14 %. The R-square is almost 12.8 % is almost same as ROA.

**Table 2 White test for ROE**

<b>ROE</b>
<b>White's test for heteroskedasticity</b>
<b>OLS, using 264 observations</b>
<b>Test statistic: <math>TR^2 = 32.391688</math>,</b>
<b>with p-value = <math>P(\text{Chi-square}(26) &gt; 32.391688) = 0.180486</math></b>

We run the same test also for MRG (MARGIN) the white test shows that the p-value is (0.000) so we use robust standard errors. We run Pooled OLS with robust standard error and we have better results in the case of Margin. Loan and deposit are not significant only. The intercept is again significant at the 1%. Internet dummy is significant at the 1% level, but negative significant that mean it decreases the MRG by 0.006%, overhead ratio and efficiency both are at the 1 % level significantly more specific negatively significant with the coefficient 0.05% and efficiency by 0.01 it is somehow related in the first look because it shows that the internet, overhead and efficiency are significant at the same level because it is expected that they are correlated with the expense and revenues. The last is msh (market share) is again significant at the 5 % level with coefficient 0.02 %.

**Table 3 White test for MRG**

<b>MRG</b>
<b>OLS, using 264 observations</b>
<b>Dependent variable: uhat^2</b>
<b>Test statistic: <math>TR^2 = 82.613802</math>,</b>
<b>with p-value = <math>P(\text{Chi-square}(26) &gt; 82.613802) = 0.000000</math></b>

**Table 4 OLS estimation with and without Robust standard Error**

Pooled OLS estimates					
	(1)	(2)	(1)	(1)	(2)
<b>const</b>	<b>0.02612**</b>	<b>0.02612**</b>	<b>8.529**</b>	<b>1.124**</b>	<b>1.124**</b>
	(0.002562)	(0.006678)	(3.579)	(0.2600)	(0.3762)
<b>la</b>	<b>5.309e-05*</b>	<b>5.309e-05</b>	<b>-0.06833</b>	<b>-</b>	<b>-0.006116</b>
	(3.077e-05)	(6.016e-05)	(0.04299)	(0.003123)	(0.004143)
<b>da</b>	<b>0.004734**</b>	<b>0.004734</b>	<b>10.53**</b>	<b>0.3557</b>	<b>0.3557</b>
	(0.002400)	(0.004310)	(3.352)	(0.2435)	(0.2370)
<b>vr0</b>	<b>-</b>	<b>-</b>	<b>-3.084**</b>	<b>-0.3107**</b>	<b>-0.3107**</b>
	(0.0007007)	(0.002056)	(0.9788)	(0.07110)	(0.1440)
<b>msh</b>	<b>0.02353**</b>	<b>0.02353**</b>	<b>14.13*</b>	<b>1.489**</b>	<b>1.489*</b>
	(0.005987)	(0.009898)	(8.363)	(0.6075)	(0.8973)
<b>inf</b>	<b>-</b>	<b>-</b>	<b>-0.2861</b>	<b>-0.04061</b>	<b>-0.04061*</b>
	(0.0003867)	(0.0002580)	(0.5403)	(0.03925)	(0.02433)
<b>intdumm</b>	<b>-</b>	<b>-</b>	<b>1.539</b>	<b>-0.03903</b>	<b>-0.03903</b>
	(0.001273)	(0.001923)	(1.779)	(0.1292)	(0.1501)
<b>n</b>	<b>264</b>	<b>264</b>	<b>264</b>	<b>264</b>	<b>264</b>
<b>R<sup>2</sup></b>	<b>0.3789</b>	<b>0.3789</b>	<b>0.1281</b>	<b>0.1388</b>	<b>0.1388</b>
<b>Dep.Var</b>	<b>MRG</b>	<b>MRG</b>	<b>ROE</b>	<b>ROA</b>	<b>ROA</b>
Standard errors in parentheses					
*significance at the 10 percent level					
**significance at the 5 percent level					
(1) Without robust standard error					
(2) With robust standard error					

Here are the results of Simple OLS after testing white test here we can see the results written above.

We expand the testing to further details as we want to get better and profound results. Opposed to the study of Kwarish and AL-Sa'di (2011) we do the Breusch Pagan test whether we choose OLS or Panel and for the three hypotheses the results are the same we have to use the panel the results can be seen in the appendix.

After Breusch Pagan test we did Hausman test whether we use random or fixed effects. For ROA we use Random Effects, for ROE we use Random Effects also, the last is MRG and we use Fixed Effects the results of test are all in the appendix.

With the model of Kwarish and Alsa'di (2011) and more banks in our model and different country we suspect that we have endogeneity. The basic explanation of the endogenous variable denotes when an independent variable is correlated with the error term. To unravel this problem we use the instrumental variable for our study as we believe that the Internet dummy is endogenous. Based on the study of De Young, Lange and Nolle (2006), the authors used four instrumental variables for Internet Dummy, but for our data set we will make two sets of Instrumental Variable. Comfort to the study, we choose secondary school, tertiary school, and job growth. The other Instrumental Variable we choose apart from the study is the Internet Usage as is strongly implicit that people that use Internet they also use Online Banking. In our study, we first test IV for tertiary and job growth, and then we test for internet and secondary. Link is very strong because at the beginning of online banking adoption they had to deal with supply of Internet in full area, and after that the usage of the Internet made costumers easier to use Online Banking. So our data for Internet usage is collected from World Bank Data as Internet users (per 100 people), for each state, for a period of twelve years. We combined the first set of Instrumental Variable tertiary and job growth, it makes sense because the tertiary school is the people that attendance college and relates to job growth because most of the students they work and study, they also need to use online banking for books, for travel for money so the style life makes people use products as in our case Online Banking. The correlation between Internet dummy and two IV: tertiary and job growth are significant the tertiary is significant at the 5 % level and job growth at 1% level of significance, in this case we prove that internet dummy is endogenous.



For the first hypothesis we are having the ROA (Return on asset) in Random Effects with Instrumental variable (tertiary and job growth). The results seem much better with the Instrumental Variables and we are sure there was endogeneity in our model. Except loan and efficiency ratio are not significant. With the help of Instrumental Variable and internet dummy we have the significance at the same level of 5% percent, but still there is a negative percentage of 1.71% that decrease the ROA (return on asset), but it is normal in some cases as that could be the adoption rate is mostly in the same period of time and not to forget that the crisis is the most part to take the blame. We also see that the deposit and overhead ratio are significant at the 5% percent level, while the deposit are reacting better in this case as they increase the ROA by 0.81% percent, but there is also expense that need to be done as the promotion of different bank products maybe some other issues and that is why vr0 is significant but decreases the ROA by 0.19 %, again msh is significant at the 1% level and increases the ROA by 2.05%. Also the IV is significant at the 5 % level and increases the ROA by 1.77%.

We continue by testing for the second hypothesis the Instrumental Variable for ROE (Return on Equity). It is obvious that the coefficients are better and significant; also here there the loan and efficiency are not significant. Internet dummy is significant at the 5 % level with the IV that is 1% significant, but it is to be concerned as here the coefficient results ,simply higher so the internet is decreasing ROE by 23.0% and the IV is increasing by 26.02 % maybe in this hypothesis the IV is not so strong. The deposit is also high with an increase in ROE by 16% at 1% level significant, msh is also high at 5% level with a coefficient 23.16 % increase at ROE. We explained at the beginning of the data that ROE shows how much profit a bank earned, maybe in this case the earning is costly, there is the overhead ratio higher and internet dummy is negatively significant so it really could be a cause of expenses or crisis.

MRG (Margin) is slightly different as expected but maybe because of the IV's and internet dummy significance not at the same level as Intdumm is significant at the 1 % confidence level and the IV is significant at 5% confidence level still the Intdumm is negatively significant with Margin by with coefficient 0.02 % while the IV is positive increasing by 0.01 %. Only on this hypothesis the loan is significant at 1% confidence level ,which the main reason is because the margin is related to the interest and also it links to the loan and is increasing actually in very low

number 0.0001 % but there is more work to do for banks in this issue. Here are deposit ratio, efficiency and overhead ratio are not significant.

We mention above that we are going to do the test in two sets of IV's as it is possible that not the same IV works for the different hypothesis. In this section we are using a combination for IV (Internet and Secondary), this is the best combination ever because the internet is very attracted to people for any reason email, watch movie, chatting , while in every web page you could see that the advertisement part of products is huge. People get attracted by some products, but not all products are available in all countries, or maybe the taste of people goes beyond the state offer products, so if they want to get the product they have to buy online, by that means they have to have online banking. It also makes sense that people that attend secondary school or teenagers are very attracted from new and challenging products as in the social parts we saw that there were cases when young people went with the flow.

In the first hypothesis, we see that ROA we are testing for IV 's (internet and secondary). The intdumm and IV's are significant at the confidence level 5% and IV is at 1% confidence level, for this case we can say that the combination of these IV's is not strong. Even here loan and efficiency are not significant. The deposit is significant at 10% confidence level with an increase of ROA by 0.53%, the market share is again significant at the 5% confidence level also the intdumm is negatively significant at the 5% confidence level and a decrease of ROA 0.46%. The IV is significant at 1% confidence level with a coefficient 0.71% increase of ROA. When we test ROE the Instrumental Variable is not significant with internet dummy at all. In the case of ROE the IV of tertiary and job growth match more than the second IV combination.

In last hypothesis with the second set of IV's the MRG seem with better results as the IV and intdumm are significant at the 1% significant confidence level, here seem that the internet and secondary really affects internet banking even though at a lower number. Here we see that basically all coefficients are low, but seem to have better result. Loan is increasing MRG by 0.0001 %, msh is increasing by 0.022% the MRG, overhead ratio is decreased by 0.001 % and intdumm is decreased by 0.01% the MRG, with the IV is increasing by 0.009 %.

In our study three hypotheses are testing whether the online banking is significant with the ROE, ROA and MRG. The expectation is whether there is a positive or negative outcome, most of the

study is done in the basic three performance indicator of banks as mention above, usually as in our study the results does not seem to be very positive, we see in all tests that internet dummy is not significant or negatively significant, the market share seems not to change at most of the cases. With the two sets of IV's the results are better, but as our intention is the internet banking and in any test there never seem to be positive and significant. The main issue could be that not all states are having the same year of adoption, or maybe the acceptance of the products takes more time and to have the positive significance of internet banking take more time and effort.

## 7. Conclusion

Innovation is positive for generating other opportunities for the businesses. In this study, apart from empirical arguments we wanted to combine the empirical with the theoretical background of the online banking.

Firstly, some social reaction reasons was provided on why and why not people like online banking. It was displayed that the adoption took a long time due to culture, education or sex reasons as previous studies, sustained these aspects influenced in technology knowledge and new banking system adoption.

From our data from 2006 till 2009 most of the countries were touched by the global financial crisis directly or indirectly. Even that our data are having some limitation of the number of banks, there are previous study done in shorter sample and had almost the same results. In our case we combined five European countries.

Most of the study was done in one country but to extend in the bigger picture, it had to combine more countries together and see how they respond.

- In our model the Left hand side the dependent variable are the same as the model of Kwarish and Al-sadi (2011), the Right hand side has some changes we include the efficiency ratio and we used the Instrumental variable
- In the first and second hypothesis we witnessed that the internet banking is not significant either in ROE, ROA that has the same result as in Kwarish and Al-sadi (2011) conclusion. While in MRG is significant at 1%, but negatively significant, that means that it affects the Margin but negatively, the main issue could be that the online banking has some commission to pay it is cheaper evidently than other product but still costs and ultimately at the beginning. The Overhead ratio in all hypotheses was significant and negative that mean the expense are present and also links with the adoption of online banking, as could be the number of IT or the system problem etc.

The other reason was that in our model we had dubious thought that we have endogeneity, so we use two sets of Instrumental Variable, combining two in the first sets and two in the second set.

The results seem better in the case of ROA, the Intdumm is significant, but negative, also the same is for ROE is significant but negative, and this is also for MRG. The deposit is significant and increasing in case of ROE, it increases a lot. The loan is significant only in the case of MRG, in the other hypothesis is not significant. What we set out here is that the internet in three hypotheses is negative significant, Overhead ratio is significantly negative, while Deposit is increasing. Maybe the reason is that by launching the online banking they increased the interest for deposit, the attraction part, but maybe the usage of online banking was not on the same line that is why also the overhead ratio is negative in one way is costly in other way deposit are increasing.

In the case of the second set of Instrumental Variable that are Internet and Secondary. Of course that in this part in two hypotheses the Intdumm is negatively significant, and overhead ratio is also the same result. In the second hypothesis ROE seems not significant with the IV so it corresponds more in the first set of IV's. The loan is significant only in the Margin hypothesis again with increase of low percentage, while the deposit as in the first set of IV's is increased in the case of ROA.

The results seem to get very challenging as it is somehow expected that it should have better effect. This suggests that apparently the banks that apply online banking need more time to develop.

As mentioned above that most of the banks adopted in 2003 while as the study of Al-Sa'di and Kwarish (2011) in their conclusion, it is proved that the effect of applying online banking is known after 2 years. DeYoung, Lang and Nolle (2006) study on which we used the Instrumental Variable they conclude that internet banking change the production cost, input mix, lending transaction, also they found out that internet banking increased the credit card lending even that does not make a good association with the product, but the last benefit on is that the wage of workers increased with the online banking as the banks gave much more importance to this product.

Our final concern is the global financial crisis has the main fault.

Our study covers the period from 1999 till 2010 and from the figure we could see that most of the banks adopted online banking as a product from 2003 mostly. From studies done for online banking we saw that there is at least 2 or 3 years after the adoption of online banking where we may perhaps start expecting the results. If that fact is true, then most of the bank adoption from 2003 till 2006 they were still in the position of whatever results, so reality strike out with only one year of profit, and then the global crisis evolved over all countries and also in Germany, Czech Republic, Great Britain, Latvia and Poland.

Main causes that made the online banking adoption not so profitable as expected, it was first the internet as basic supply in some countries they have not even had internet till 2001, than adoption of online banking and the link between social and economic issue merely did help, and third the global crisis that is the final hit for commercial banks and extremely for the online banking product.

Online Banking Adoption

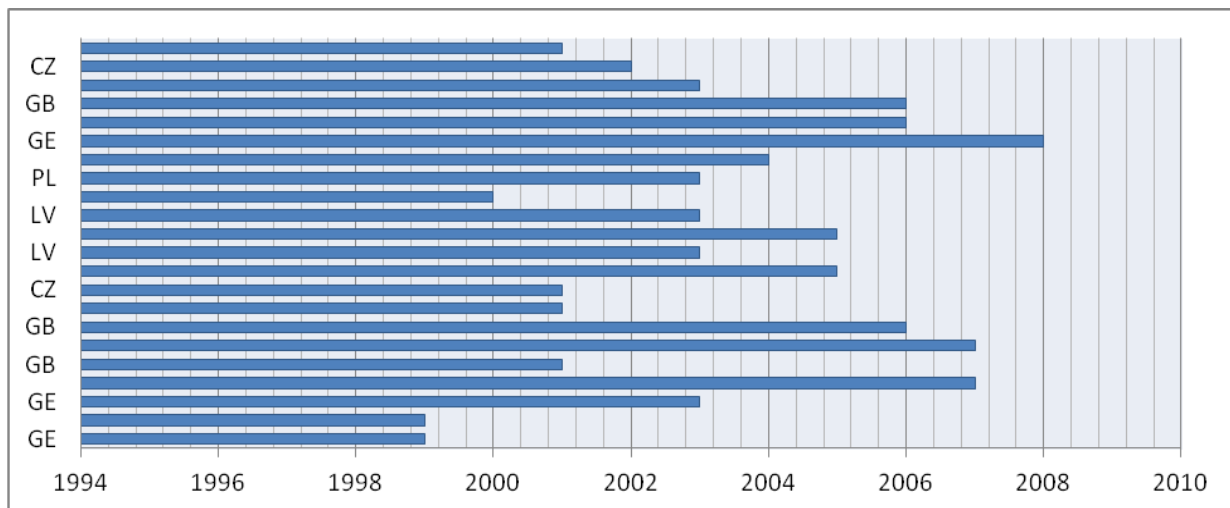


Figure 16 Internet adoption in all countries

Source : Author computation

Our core conclusion is that the half of the study data set is part of the reflection of global financial crisis and it is comprehend that it pinched the adoption of online banking and that is why we have the rare results.

Lastly, it is believed that further study in the future that has to be done for the online banking would be the period of study from 2010 to the future, and will be less affected by the global financial crisis.

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## APPENDIX

Here are two sets of Instrumental variable as Secondary for secondary school, Tertiary for college, JG for Job growth, inter for Internet Usage.

**Table 5 Two sets of Instrumental Variable**

<b>Pooled OLS estimates</b>		
<b>Dependent variable: intdumm</b>		
	<b>(1)</b>	<b>(2)</b>
<b>const</b>	<b>-0.07436</b>	<b>-0.5536**</b>
	<b>(0.2601)</b>	<b>(0.2213)</b>
<b>la</b>	<b>0.001424</b>	<b>-0.001263</b>
	<b>(0.002917)</b>	<b>(0.002624)</b>
<b>da</b>	<b>0.3109</b>	<b>-0.02558</b>
	<b>(0.1886)</b>	<b>(0.1646)</b>
<b>vr0</b>	<b>0.03740</b>	<b>0.02425</b>
	<b>(0.03979)</b>	<b>(0.02890)</b>
<b>msh</b>	<b>0.5601</b>	<b>0.8904**</b>
	<b>(0.5441)</b>	<b>(0.3571)</b>
<b>inf</b>	<b>0.002178</b>	<b>-0.008929</b>
	<b>(0.01695)</b>	<b>(0.01159)</b>
<b>tertiary</b>	<b>0.02611**</b>	
	<b>(0.01093)</b>	
<b>jg</b>	<b>-0.01014*</b>	
	<b>(0.005468)</b>	
<b>second</b>		<b>0.007634**</b>
		<b>(0.002457)</b>
<b>inter</b>		<b>0.01402**</b>
		<b>(0.001241)</b>
<b>n</b>	<b>264</b>	<b>264</b>
<b>Standard errors in parentheses</b>		
<b>*significance at the 10 percent level</b>		
<b>**significance at the 5 percent level</b>		

**Table 6 Results of Instrumental Variable for MRG**

<b>Fixed-effects estimates</b>	
<b>Dependent variable: mrg</b>	
	(1)
const	0.02141** (0.005722)
la	0.0001900** (8.861e-05)
da	0.007664 (0.007502)
vr0	-0.0006153 (0.001130)
msh	0.02866** (0.01302)
inf	-0.0003039 (0.0004451)
intdumm	-0.02153** (0.006605)
JG	0.01546** (0.006758)
n	264
<b>Standard errors in parentheses</b>	
<b>* significance at the 10 percent level</b>	
<b>**significance at the 5 percent level</b>	

**Table 7 Results of Instrumental Variable for ROA and ROE**

Random-effects (GLS) estimates			
	ROA		ROE
	(1)		(1)
const	1.590** (0.3614)		16.86** (5.042)
la	-0.002021 (0.004224)		-0.01088 (0.05949)
da	0.8199** (0.3330)		16.80** (4.697)
vr0	-0.1965** (0.07894)		-2.303** (1.096)
msh	2.014** (0.7400)		23.17** (10.40)
inf	-0.03406 (0.04048)		-0.3963 (0.5599)
intdumm	-1.715** (0.6738)		-23.01** (9.401)
JG	1.773** (0.6966)		26.03** (9.727)
n	264		264

**Table 8 Results of Instrumental Variable for ROE, ROA and MRG**

	ROA		ROE		MRG	
	(1)		(1)		(1)	
<b>const</b>	1.205**		10.75**		0.01872**	
	(0.2914)		(4.057)		(0.004631)	
<b>la</b>	-0.005302		-0.06123		0.0001730**	
	(0.003760)		(0.05257)		(8.155e-05)	
<b>da</b>	0.5343*		12.35**		0.006416	
	(0.2933)		(4.102)		(0.008349)	
<b>vr0</b>	-0.2538**		-3.057**		-0.001285	
	(0.07506)		(1.042)		(0.001216)	
<b>msh</b>	1.597**		16.47*		0.02221*	
	(0.7008)		(9.781)		(0.01198)	
<b>inf</b>	-0.04840		-0.5712		-0.0005128	
	(0.03984)		(0.5522)		(0.0004672)	
<b>intdumm</b>	-0.4664**		-3.732		-0.01282**	
	(0.2074)		(2.874)		(0.003456)	
<b>IS</b>	0.7196**		8.944**		0.009506**	
	(0.2670)		(3.699)		(0.002890)	
<b>n</b>	264		264		264	
<b>Standard errors in parentheses</b>						
<b>* indicates significance at the 10 percent level</b>						
<b>** indicates significance at the 5 percent level</b>						



**Table 9 Banks, Countries and Online Banking adoption**

<b>Banks</b>	<b>Countries</b>	<b>Online Banking</b>
Commerzbank AG	GE	1999
Deutsche Postbank AG	GE	1999
Isbank GmbH	GE	2003
J&T Banka as	CZ	2007
ABC International Bank Plc	GB	2001
Turkish Bank (UK) Limited	GB	2007
National Bank of Kuwait (International) PLC	GB	2006
Ceskoslovenska Obchodni Banka A.S.- CSOB	CZ	2001
Komercni Banka	CZ	2001
SGB Bank SA	PL	2005
Rietumu Bank Group-Rietumu Banka	LV	2003
Bank Pocztowy SA	PL	2005
UniCredit Bank AS	LV	2003
SEB banka AS	LV	2000
RBS Bank (Polska) SA	PL	2003
Degussa Bank GmbH	GE	2004
Fürstlich Castell'sche Bank, Credit-Casse AG-Castell Bank	GE	2008
Northern Bank Limited	GB	2006
RBC Europe Limited	GB	2006
Trasta Komercbanka-Trust Commercial Bank	LV	2003
Modra pyramida stavebni sporitelna as	CZ	2002
Raiffeisen stavební sporitelna AS	CZ	2001