# **DOES SPECIALIZATION MATTER FOR BANK FINANCIAL**

# **STABILITY: EVIDENCE ON PANEL DATA**

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# Abstract

The present research states and investigates two questions about the role of bank specialization type – commercial, cooperative, savings and investment – on individual and overall financial stability using cross country data for seven years. It was found that cooperative banks are the most stable type of bank specialization, followed by savings banks. Commercial banks made up the third place, while investment banks are the most unstable type of bank specialization. The effect of the presence of a particular bank specialization type on the change in the stability was considered as well. And results of empirical estimation show that cooperative and investment banks have negative effect on overall financial stability of the system, while savings banks, increasing their share in the market, have beneficial effect on stability. Therefore, the research confirms that specialization of the bank is important factor influencing individual and overall financial stability.

# 1. Introduction

Financial stability nowadays is probably the most important target of most policymakers around the world in general and central banks in particular, since along with persistent growth and development of financial and particularly banking sector in the last couple decades there were very frequent financial turbulence, which caused a country specific or world crises. It has become obvious that the losses from crisis resolution are much higher than spending for maintaining financial stability as an arrangement for crises prevention. But in spite of the public's focal point on financial stability, it seems that policymakers only understand that it is important for normal operating of the economy, but do little to investigate it deeper. Frequent occurrence of world financial crises proves it, since many of important issues regarding financial stability are still unclear. Even the definition of financial stability itself is vague since it is not mutually agreed on. Many researchers have come up with different ideas about what exactly financial stability means. Particularly, very useful definition given by Crockett (1997) suggests that "financial stability (refers) to the stability of key institutions and markets that go to make up the financial system...stability requires (i) that the key institutions in the financial system are stable, in that there is a high degree of confidence that they continue to meet their contractual obligations without interruption or outside assistance...". This definition of financial stability will be used in this research since it concentrates on the question of investigation – stability of the most important financial institutions of today's life - banks.

Most central banks and banking policymakers all over the world carry out a mandate of encouraging financial stability in their countries. The present tendency is

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that there is intensification of financial policymakers' concentration on financial stability issues because of huge losses from financial instability and crisis. Rich past experience suggests that in most cases financial instability leads to the financial crisis, which in turn leads economies into deep depression. Many financial crises were contagious and quickly crossed borders reaching countries with no obvious vulnerabilities. Laeven and Valencia (2008) in their working paper "Systemic banking crises: a new database" found 208 currency crises, 63 sovereign debt crises and 24 systemic banking crises over the period 1970 to 2007 which are all parts of financial crisis. The three top financial crises which brought the biggest losses are the Latin America debt crisis (1980's), the Asia financial crisis (1997-1998) and the world financial crisis (2007). The recent crisis vividly provides an example how the crisis can start from one country (USA) and spread out for the whole world, leading to deep world recession and distress.

That is why everyday growing empirical and theoretical literature studies financial and banking crises and unanimously confirms that smoothly operating financial environment hastens economic growth by means of distribution the scarce financial recourses more efficiently than the badly-functioning system (see e.g. Macey 1999, Goodhart and Tsomocos 2007). Particularly the well-operating banking system is one of the most significant elements of financial structure as was continuously and intensely verified by current development all over the world. The interconnection between bank failures and overall financial instability is complicated and works through different ways. The transmission mechanism operates in two sides. Prevalent bank failures can be caused by a negative shock for the real production or asset prices representing a connection from financial instability to banking crisis. Meanwhile bank system insolvency will lead to general system-wide

shocks to real production and represent a connection from banking crisis to expanding financial crisis.

Such close interconnection between bank distresses and overall country crisis makes researchers investigate all the possible factors on micro and macro level. As a consequence of such research there are a lot of empirical studies concerned with the connection between economy fragility, and particularly financial fragility and banking insolvency where 1) the role of central banks in the maintaining financial stability is stressed<sup>1</sup> and 2) the role of bank ownership in the financial effectiveness and stability is stressed.<sup>2</sup> Unfortunately, the theme of banking specialization structure and the degree of which banks of one specialization are affected by another via bilateral influence is still vague. What is the effect of banks of particular type on the overall financial stability? In the presence of multilateral effect is there unique bank type specialization that ensures avoiding systematic shocks? And actually does specialization matter at all for the health of financial sector? These and many other related questions are still waiting to be answered in the future. In spite of many unanswered questions there are done some actions and researches to clarify this obstacle questions but again the literature that exists in economics investigates only one particular type of bank specialization (see e.g. Mekki 2008; Al-Obaidan 2009; Impavido, Musalem and Tressel 2001). Unfortunately to date there is no comprehensive empirical research or literature investigating the influence of different type of banking specification on the financial stability, where under bank

<sup>&</sup>lt;sup>1</sup> For detailed information see "Should financial stability be an explicit central bank objective?" by Ferguson (2002); "Financial stability: objectives and challenges for central banking" by Hildebrand (2007); "Central banks and financial stability: exploring a land in between" by Padoa-Schioppa (2002) and others.

<sup>&</sup>lt;sup>2</sup>For more details on this topic see "Bank ownership and stability: Evidence from Germany" by Beck, Hesse and Kick (2009); "Bank ownership, market structure and risk" by Nicolò and Loukoianova (2006); "Bank ownership and efficiency in China: what lies ahead in the world's largest nation?" by Berger, Hasan and Zhou (2007); "Bank ownership and performance. Does politics matter?" by Micco, Panizza and Yañez (2006); Barth, Caprio and Levine "Banking systems around the globe: Do regulation and ownership affect performance and stability?" (2000); and "Bank ownership and efficiency" by Altunbas, Evans and Molyneutc (2001), etc.

specialization one might think of the field of activity of financial intermediary, or the market of the business or even the focus on particular target group of consumers of banking services. So, the present research makes effort to fill in this gap in the empirical studies and tries to find answers for two main questions based on micro level data for 27 and 15 countries of European Union:

- 1) Does one particular bank specialization type have a superior power over other types to react to distress because of the peculiarities of its sphere of activity?
- 2) Does the presence of a particular bank specialization type change stability of the financial system?

Thus, this research provides answers for questions of concern presenting cross country empirical analysis of the role of banking specialization for the financial stability based on data from the European Union 27 and 15 countries. Since the cross country area was chosen, there is a higher chance that true effect of different bank specialization types on the financial stability in EU 27 and 15 will be estimated. The main finding of the study is that specialization is indeed important both for individual and overall financial stability.

The research is organized in the following way: Chapter II provides some literature review both theoretical and empirical for the investigated topic in detail. Chapter III concerns data description. Chapter IV presents methodology used. Chapter V presents regression analysis and received results and gives explanation to them. Section VI concludes.

## 2. Literature Review

This chapter provides short review of previous research related to this study. And since this research presents the empirical study of interconnection between financial stability and bank specialization type investigated by special technique in financial economics called the "Z-score" three types of studies will be concerned those related to financial stability, those related to bank specialization and finally, those related to the Z-score.

This research, on one hand complements growing theoretical and empirical studies which investigate the factor of risks for financial stability, but on the other hand, it concentrates particularly on one such risk – bank specialization type and tries to fill the gap in the scant literature on this topic.

After careful investigation of available literature on factor risks of financial stability the main conclusion follows that the analysis of financial stability is impeded by the absence of unique and broadly agreed definition of the term "financial stability", which is actually the main challenge for all researchers. Thus, unique factor risks are difficult to determine for some country, not mentioning for large regions or even for the whole world. As a consequence of non obvious risk factors for financial stability one cannot construct unique financial stability model which includes broad range of risk factors, which are in turn obscure.

For example in one of the recent research Goodhart et al (2005, 2006) argues that financial stability depends on the welfare effects and distributional outcomes for the duration of financial instability. The authors claim that likelihood of default of banks and other economic agents illustrates financial instability in the country. On the other hand Issing (2003) and Foot (2003) supposed that financial stability

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depends on economy bubbles and broadly speaking on volatility in financial market proxies. Other researchers offered the definition of financial stability based on institutional approach. For example Haldane et al (2004) being among such scholars stressed out that the volatility from steady state investment-savings plan must be an essential element in the financial stability models.

So, instead of usage the single model which will incorporate all possible factors affecting financial fragility, scholars argue about using different financial stability models which have different properties to be able to answer the question of interest.

Since this research aims to concentrate solely on bank specialization as one of the factors affecting financial stability, it would be useful to present some existing literature on this topic. But as was mentioned in the introduction there are few studies examining exactly the effect of bank specialization on the overall financial stability. There exist some studies investigating the interplay between financial stability and one particular type of bank specialization, where usually commercial banks are used as benchmark for comparison. For example Ariff (1998) investigates Islamic banks as one of the types of bank specialization.

Another type of bank specialization investigated is cooperative banking. For example Hansmann (1996) and Chaddad and Cook (2004) present empirical evidence illustrating that cooperative banks do not usually accept high risk contrary to demutualized banks and as a results they are more financially stable than demutualized banks. In contrast to their point of view several scholars claimed that cooperative banks increase the possibility of financial and banking particularly crisis. Among them are Goodhart (2004) who led by the empirical evidence from Barth, Caprio, and Levine (1999) claims that the presence of any non-profit-maximizing banks (cooperative banks specifically) make financial stability less strong and stable.

While there are some studies concerning commercial and investment banks, there is not enough research where the importance of these two types of bank specialization for financial stability is stressed. Therefore the main limitations of previous research are either the narrow concentration on one particular bank type or absence of interconnection between bank type and financial stability. That is why this research is meant to fill in the gap in the empirical literature concerning several bank types simultaneously and effect of particular bank type on the financial stability. The main result of the present research is that it finds evidence that specialization matters for individual and overall financial stability of the system. Another point worth mentioning is that since commercial, cooperative, investment and savings banks are the most widespread, because the total assets of the banks of these four types account for 80-90% of total assets of all banks, the main objective of this research is to concentrate solely on them.

In order to investigate the connection between specialization and stability, there exist some methods or techniques to do so. The system of indicators representing the fact that some banks are distressed and it can cause overall distress for the whole financial environment appeared in USA in the early 70's. Hence, insolvency prediction models have long history in empirical literature. The very first model – the Z-score - was suggested by Altman (1968) who claimed in his famous paper that likelihood of failure depends heavily on certain financial structure. Altman's analysis is based on 66 industrial companies for 20 years sample period. Altman's multivariate discriminant analysis on industrial companies was an example, which many researchers used later on in their studies. Among them were Stuhr and van Wicklen (1974), Sinkey (1975), Altman (1977), Boyd and Runkle, (1993) and many others. But researchers by and large now use the modified version of the Z-score

offered originally by Martin (1977), who offered multivariate discrete models of bankfailure prediction. Banking warning models first got their speedy development in 1990's after the crisis in Scandinavia occurred. Failure prediction models of banking sector were also developed in Europe with some variations from original Altman's Zscore. Most of variations in the original Z-score done in European research concerned with different ratios used to construct Z-score itself, but still European research are heavily based on USA studies.

Thus, the importance of peculiarities of banking activity among different bank type specialization and its implication for financial stability did not get enough attention from scholars. Also, among the existing studies the evidence is mixed implying additional research is needed. Therefore, this study will be among the research that shed some light on several obscure questions.

# 3. Data Description

This chapter will describe the main features of the data and the dataset, from which the data was drawn and also it exposes the main moments of building the sample used for the analysis. Most of the data for calculations and research were received from comprehensive worldwide database called BankScope. BankScope database is exclusive to Bureau van Dijk Electronic Publishing (BvDEP). This database is unique because it contains micro data for more than 29,000 banks and financial institutions across the world. Each bank's report has detailed consolidated and unconsolidated statements of its balance sheet. In addition to data from balance sheets of the banks different financial ratios, ownership types, news, security and price information, ratings provided by 4 agencies can be drawn from the database. Overall, the research database used in thesis is undeniably useful and helpful especially for academic researchers and research departments since the database provides credible level of information and analysis for research and teaching; for central banks which can make conclusion about financial situation among the banks of some country and hence about financial system fragility of the country; for individual banks as well since each bank can compare its financial situation with its peers on the bank market; for investors who can choose a bank which they want to invest funds in since they can pick the bank according to their priorities - the most safe, the most reliable, the most profitable and so on.

In addition to the BankScope database, some data were taken from the International Monetary Fund.<sup>3</sup> The IMF publishes time series data concerning macroeconomic and financial indicators, and also some analysis and forecast of IMF

<sup>&</sup>lt;sup>3</sup> For detailed information see World Economic Outlook Database October 2009 at www.imf.org

staff about world and country specific economy development. In IMF database data is available since the 1980's, and also two years predictions are presented.

For the purpose of the investigated topic, the main criteria for filtering banks from the whole range of banks and financial institutions were 1) geographic and 2) bank specialization. This study concentrates on the analysis of financial stability in European Union 27 countries, since this region, comparing to other regions, gives broad sample of developed and still developing countries with different background in financial institutions development. Hence, there is no strongly dominant bank type specialization and even vice versa all of specialization types are represented, which makes analysis more extensive and comprehensive.

The main types of bank specialization mentioned in the BankScope database include the following categories of banks and financial institutions: savings, commercial, cooperative, Islamic, investment, central, real estate and mortgage, medium- and long term credit, bank holdings, governmental credit institutions, multilateral governmental, non banking credit institutions. Since the confidentiality agreement with the data provider does not allow for disclosure micro data, concerning particular bank's financial balance sheet, it still allows for a representation the data in aggregate format with respect to country level. In table 1 there can be found detailed information concerning the number of the bank in different regions all over the world.

Table 1 – Number of the banks all over the world

North America	13911
Eastern Europe	2463
Middle East	431
Oceania	402

South and Central America	2267
Far East and Central Asia	3609
Europe (excluding eastern Europe)	12218
EU 15	10692
EU 27	11337

Since the first criterion for the bank selection was geographical, it predetermined the choice of the bank type specialization in that way that only those types of banks that dominate in chosen area, i.e. EU 27 countries, were included in the second criterion. As a result four types of bank specialization were chosen: 1) savings, 2) cooperative; 3) commercial; 4) investment. So, overall, the analysis includes seven years beginning from 2001 and ending up with 2007, and in particularly for 6144 banks. Out of all these banks four investigated types of banks have the following shares, presented in table 2:

Bank type	In the world	In EU 27
Savings	3132	1404
Cooperative	4390	3559
Commercial	19964	3773
Investment	2168	732

Table 2 – Number of investigated banks of different specialization types

Hence, out of 11337 of existing in EU 27 banks, these four types of bank specialization make up 83.5%. For the purpose of research it is necessary to mention main features and characteristics of different bank types.

## 3.1 Characteristics of Four Bank Specialization Types

This sub chapter provides short narrative description of distinctive features of investigated bank types. Commercial banks make up the largest share in the investigated bank sample. Under commercial bank people usually understand a financial institution which offers different deposit accounts like checking, demand, savings and time deposits. The main objective of commercial banks is to maximize profit, unlike for example cooperative banks. Another distinctive feature of commercial banks is that though sometimes they can work with individuals, the main field of activity, i.e. accumulating deposits and lending to middle- and big size business. So, commercial banking may also be seen as distinct from retail banking services which involve the provision of financial services direct to business consumers. That is why the second name of the commercial bank is "business bank". Another important feature of commercial banks is that, as group, commercial banks can expand money supply, by creating new demand deposits, since commercial banks must keep only a part of its deposits as a reserve, the biggest part of the deposit in turn is transferred to offer new loans. Additional peculiarity of commercial banks is that usually they do not deal with long-term loans, preferring to focus on short-term loans, unlike the investment banks which act as an intermediary for long term obligations and investments.

Cooperative banks make up the second largest share in the bank sample. This type of bank has its particular features which distinguish it from others. The most important is that these financial institutions belong to the shareholders who are both owners of the bank and also customers of the bank. Usually such banks are organized by people who live in the local community and have some common

interests or spheres of activity. There are also other features of cooperative bank which make it different from other types of banks. First - since owners of the bank are customers at the same time, hence the satisfying the needs of the customers, the needs of owners will be met as well. Therefore, the main target of cooperative bank is not to maximize its profit, but to give the best service to its members (owners). But there are also some situations when cooperative bank provides services to clients who are not owners of the bank in order to diversify its activity and increase profits from banking activity. Second - since cooperative banks belong to its members, these members usually have equal rights to perform their voting. Moreover, the most usual principle in cooperative banks is "one person, one vote". As was mentioned above, since most cooperative banks are organized by people from one community, such banks usually put a lot of efforts to help its local community get persistent development as most customers and hence owners belong to this community where particular cooperative bank provides its services. Therefore, this form of bank organization was proved to be successful in many developing and advanced regions and countries and nowadays expands more and more all over the world.

Savings banks have one of the longest histories in the financial world. Such banks appeared in Europe in the 18<sup>th</sup> century. Usually savings banks are financial intermediaries that concentrate on servicing such functions as receiving savings deposits of individuals, investing them, and providing a modest return to its depositors in the form of interest. The best known form of savings bank is the mutual savings bank, which is the unique type of bank because it focuses exclusively on accumulating deposits, which was especially the case in the past. Usually mutual savings banks were state-privileged organization, owned by their depositors and

managed for their mutual benefit by self-perpetuating boards of trustees. Nowadays the situation has changed a lot for savings banks, because to survive in competitive atmosphere of banking business, savings banks has started performing other functions as well in addition to accepting deposits, such as giving credits, insurance for individual clients and for small size corporate clients. The main distinctive feature of savings banks is that they have the dispersed distribution network, offering regional outreach, hence focusing on social responsibility to corporate business, individuals and society as a whole. But overall savings banks, as most other bank types, generate savings from those who want to spend less than they earn and transfer these generated deposits to those who want to spend more now than their incomes. Many savings banks were organized as an action of good will to encourage people of modest means to save. But unlike many other types of banks, savings banks do not accept demand deposits.

Finally let us consider investment banks. The main field of activities of investment banks includes buying out all new securities issued by some corporate business at one price and selling out parts of securities for the public investment at higher prices in order to earn brokerage profit. In this case the most important duty of the investment bank is to determine the right price offered to the public for securities on the basis of the equilibrium of supply and demand and on the forecast of financial situation. Usually to avoid accepting the huge risk for placement of newly issued securities alone, instead of the single bank, a consortium of investment banks is organized to share the risk of new issue. So, the most widespread definition given to investment bank is that an investment bank is a financial institution that deals with raising capital, trading in securities and managing corporate mergers and acquisitions. Therefore, one of the services provided by such type of banks is that

investment bank helps its clients to accumulate necessary funds in the capital markets.

Another branch of activities performed by investment banks is consultancy to corporate clients in the field of mergers and acquisitions, where investment bank helps its client to pass through negotiation process with merger target, to monitor bidding for merger and acquisition. Consultancy can also be provided in the fields of foreign exchange, financial derivatives and so on. The activity of the investment bank in this case starts with pre-underwriting counseling and goes on further up to the allocation of securities in the form of advice. One of distinctive features of investment banks is that investment banking division is usually divided by two branches: industry coverage and product coverage group. Industry coverage part of investment bank usually deals with some particular industry, such as for example oil and gas, pharmacology, real estate and so on, and tries to involve companies from specific industry into investment bank. On the other hand, product coverage division of investment bank targets specific products, such as equity, mergers and acquisitions, leveraged finance. Product coverage division of investment bank works closer with corporate clients and meets their very specific needs.

#### 3.2 Database Description

Though BankScope database is credible database which is in great demand of financial analysts and researchers, there are some limitations of the database, which are worth to be mentioned. First of all, in spite of broad and rather inclusive range of data about banking and not banking sectors of economy containing in BankScope database, its coverage unfortunately is not full. Data reporting depends on the

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country. It is natural that in most of advance economies the data coverage is rather large and includes 70% - 90% of all bank assets in the economy; quite different situation in developing and poor countries, where data coverage is low and not completely credible. It would be reasonable to make the same analysis using another financial database to check the consistency of results but unfortunately the absence of similar comprehensive database makes it impossible. But this issue was to some extent mitigated because the analysis includes countries of European Union, which usually collect credible and full financial data, though with some exceptions. In this case where there are data gaps, averaged values for seven years were used to fill in the gaps for the purpose of econometrical analysis. Acting in this way will decrease measurement error, otherwise the panel data turns into the three dimensions unbalanced panel data, which while processing gives spurious results.

Another minor complication with the data collected for the analysis is that sometimes some banks change their status (investment, savings, cooperative or commercial), by changing the sphere of their activity or simply by mergers and acquisitions. There were some cases, when at the beginning of the research period, a bank was for instance investment and later changed its activity by re-qualifying to become a savings bank. Therefore, it is logical to suppose that the sample of savings banks for example contains some banks which were investment or cooperative or commercial. Though the data was purified as much as possible to avoid measurement error, unfortunately because of huge data sample, it was not possible to check every bank for the whole history of its performance on the banking sector. Where it was possible to credibly state that that the bank belonged for most of the investigated time period to different bank group, its status was changed. But still in spite of the fact that individual checking of each bank specialization was not

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achievable, it is reasonable to assume that this small limitation in dataset did not cause significant problems.

The last point about limitations of database to be mentioned is that data in BankScope database contains, as it was said above, both consolidated and unconsolidated balance sheets of the banks. To avoid duplication of the data of the same bank twice it was mandatory to choose just one of two means of data consolidation and another should have been just cancelled out from the sample. It would be easy to do if BankScope database would contain for each bank both consolidated and unconsolidated balance sheets. Unfortunately, some banks have only a consolidated statement; meanwhile other banks have only unconsolidated balance sheets. Hence, it was necessary to lose some data choosing some one of the two levels of consolidation in data in order to get purified data sample. And again it would be more rational of course to choose consolidated statements, because the parent company incorporates data from all of its daughter companies and branches, but taking into consideration that almost all represented data is unconsolidated balance sheets, there was no other option but to reject consolidated statement and exclude them from the sample and hence from the analysis. It should be pointed out that such elimination does not lead to selection bias since the elimination of such banks did not depend on the specialization or geographical location - two main selection criteria.

# 4. Methodology

In order to give answers to two main questions outlined in the introduction, this chapter describes methodology used in the analysis, provides its prehistory and verifies its appropriateness.

Secured and successful operation of the banking sector all over the world is one of the main aspects of consistent and advanced world economic growth. The global financial market crashes recently and through the history exposed various possible vulnerability factors in the world financial system and increased the risk of these factors coming into motion. That is why most recent research focus on studying and analyzing of these risks in order to reveal factors which are helpful in providing and supporting the stable operation of the financial institutions all over the world and financial system as a whole (see e.g. Haldane, Hoggarth, Saporta and Sinclair 2004, Haldane, Hall and Pezzini 2007, Nier, Yang, Yorulmazer and Alentorn 2008).

Because of such a necessity to measure financial stability in order to have a stable financial environment many researches focused on usage both old or new methodological instruments and methods to deepen their investigations. Among all the widely used means of assessment of financial stability either within one country or within big regions and worldwide the so-called technique "Z-score" allows using micro prudential on the basis bank-to-bank level data to analyze factors affecting the whole financial system. This technique was first developed by Edward Altman (1968) who approximately four decades back set out to answer one simple question "which businesses are likely to go bankrupt and which are not?". Altman constructed a mathematical model for predicting the probability that a firm would go bankrupt. In his model Altman suggested five main indicators, which allow due to weighting

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system introduced by Altman as well, to evaluate the probability that some particular business will be bankrupt. Originally the Z-score methodic was focused on manufacturing companies, but later Altman made some modification in the model so it can be used now for a wider range of companies. So, five main indicators suggested by Altman which determine the likelihood of bankruptcy are the following:

 $T_{1} = \frac{\text{Working capital}}{\text{Total assets}}$   $T_{2} = \frac{\text{Retained earnings}}{\text{Total assets}}$   $T_{3} = \frac{\text{Earnings Before Interest and Taxes}}{\text{Total assets}}$   $T_{4} = \frac{\text{Market value of equity}}{\text{Total liabilities}}$ Sales

$$T_5 = \frac{0 \text{ ares}}{\text{Total assets}}$$

Altman weighted these indicators in the following way:

$$Z = 1.2T_1 + 1.4T_2 + 3.3T_3 + 0.6T_4 + 0.999T_5$$

Since this model could not capture peculiarities of non manufacturing companies Altman made 2 modifications which allow using the model for private manufacturing firms and for private non manufacturing companies. For privately held manufacturing firms the indicators are the same but weighting system is different:

$$Z = 0.717T_1 + 0.847T_2 + 3.07T_3 + 0.420T_4 + 0.998T_5$$

For privately held non manufacturing companies the model uses only first four indicators and eliminates fifth indicator because it changes widely among non manufacturing companies which are usually not capital intensive. Altman used other weighting system in the second modification:

The range for the Z-score is the following - Original Z-score model - If the score is 3.0 or above - bankruptcy is not likely. If the Z-score is 1.8 or less - bankruptcy is likely. A score between 1.8 and 3.0 is the gray area.

- Z-score for private manufacturing company – if a score of 2.90 or above bankruptcy is not likely, but a score of 1.23 or below is a strong indicator that bankruptcy is likely.

- Z-score for private nonmanufacturing firms – if a score of 2.60 or above - bankruptcy is not likely, but a score of 1.10 or less indicates that bankruptcy is likely.

Loosely speaking, the particular bank uses the Z-score technique to assess its likelihood of success and failure on the basis of its financial balance sheets. Putting it the other way Z-score is a common measure of financial health of company.

Two decades later, the original variables of Altman were changed a little bit to customize them to peculiarities of banking sector and since then Z-score technique became very popular among banking analysts. Since this research is focused of financial stability and the institutions of interest are banks, only the way of Z-score calculations applicable to banks is presented and used in calculations. Particularly, the state of insolvency can be characterized as a case when losses are higher than profits. Specifically, theoretically the z-score can be described by the following model, which characterizes factors, leading banks or any other financial intermediaries to distress and inability to pay their debt:

 $P(\pi < -E) = f(macroeconomic factors and conditions, profitability, size, bank speacilization, ownership, etc.)$ 

Where P – probability,  $\pi$  - total profit, E – equity capital, f - function of the factors leading to bank insolvency.

Thus, modified version of Altman's z-score widely used by Roy (1952), Hannah and Hanweck (1988) and Boyd, Graham and Hewitt (1993) can be mathematically described as

$$Z_{i,t} = \left[\frac{\sigma_i(ROA_{i,t})}{E_i(ROA_{i,t} + CAR_{i,t})}\right]$$

Where ROA - return on assets;

CAR - capital-asset ratio;

σ - standard deviation of return on assets;

square brackets mean inverse function.

Hence, the bank is defined as insolvent if its losses are more than its equity I.e.  $E < -\pi$ . Putting it the other way, if

$$ROA_{i,t} = \frac{\pi_{i,t}}{A_{i,t}}$$
 and  $CAR_{i,t} = \frac{E_{i,t}}{A_{i,t}}$ 

where A is defines as total assets of the bank, then the probability that the bank will become insolvent is P(-ROA < CAR). Hence, if one makes the assumption of normal distribution of bank profit, than it can be proved that

$$Z_{i,t} = \frac{ROA_{i,t} + CAR_{i,t}}{\sigma_i(ROA_{i,t})}$$

which is inverse of the probability of insolvency.

In other words the Z-score can predict the probability that banks assets will become less than the value of its debt, which can be important information for many people of different types of professional activities. Therefore, this measure of bank financial stability indicates the number of standard deviation a return has to be within to exhaust equity, assuming that bank's returns have normal distribution. So, the higher Z-score the lower the likelihood of bank collapse and the lower the upper limit of banking failure i.e. loosely speaking Z-score can be considered as a measure of «distance-to-default».

The general conclusion about Z-score method is that on average it can be of help to foresee bankruptcy during next two years with 80% exactness, and during next five years with 70% precision. But these statistics should be taken into consideration with caution because the Z-score cannot forecast when some particular firm will enter into official bankruptcy procedure; it just resembles mirror indicator because it gives peer judgment, comparing the financial situation of this particular firm with companies which got bankrupt. That is why the Z-score is a good measure of economy distress because it gives general description of the state of financial sector in the entire economy or world since based on econometric analyses, the Z-score determines types of risks and shocks which have high probability to have an effect on the financial system of the country or world as a whole.

Therefore, the main conclusion about this method is that it permits to estimate the correlation among bank stability, banking vulnerability factors and general economical environment. The only question which can pop up in mind is whether Z-score is appropriate method of assessing financial stability for different bank specializations. The answer to this question is positive and the reason behind it is that Z-score reflects the credible measure of bank insolvency in spite of type of financial institution because all types of banks face similar risk of bankruptcy if they exhaust their capital. This is exactly the risk captured by the z-score, which has the same methodology for any type of bank. The analysis will proceed by presentation different Z-scores which will be compared within different bank types and since the size of the bank has important meaning big banks will be separated from small in the analysis.

# 5. Regression Analysis and Results

As was stressed in the introduction one of the main questions of interest is which of four types of banks is more resistant to financial crisis. To answer this question econometrical analysis with the usage of statistical and econometrical package Eviews6 was applied by running regressions of Z-score as a function of independent variables. Panel model was estimated since the sample included cross section within banks and also time series for seven years.

$$\begin{aligned} \boldsymbol{z}_{i,j,t} &= \alpha + \beta C_{i,j,t-1} + \gamma D_{j,t-1} + \sum \delta_s F_s + \sum \varepsilon_s F_s D_{j,t-1} + \sum \theta_s F_s C_{i,j,t-1} + \rho M_{j,t-1} \\ &+ \sum \vartheta_j K_j + \sum \pi_t L_t + \varepsilon_{i,j,t,j} \end{aligned}$$

Where  $z_{i,j,t}$  - Z-score at time t for bank i in country j,  $C_{i,j,t}$  - a vector of bankspecific variables,  $D_{j,t-1}$  - a vector of time-varying industry-specific variables,  $F_s$ ,  $F_s D_{j,t-1}$  and  $F_s C_{i,j,t-1}$  - the type of banks specialization and the interaction between the type and some of the industry-specific and bank-specific variables,  $M_{j,t}$ ,  $K_j$  and  $L_t$  - vectors of macroeconomic variables, country and yearly dummy variables, respectively and finally  $\varepsilon$  is the residual.

Since one of the main purpose of the research is to determine the most financially stable type of bank, there are three bank type dummies are included in regression. The first of these dummies takes value 1 if bank of interest is cooperative and 0 otherwise. The second dummy takes value 1 of the bank of concern is investment and 0 otherwise and finally, the last bank type dummy takes value 1 if the bank of question is savings and 0 otherwise. So, if one of four types of banks specialization has an advantage over other bank types it will be shown by positive sign and bigger coefficient at the particular bank specialization dummy.

In order to provide the answer to the second question of concern outlined in the introduction about the impact different bank type has on overall financial stability in the EU 27 countries market shares in each year of different bank types were calculated due to available information in BankScope database and necessary interaction with relevant bank type dummies were done. If such interaction will have positive sign it will mean that increasing the number of banks of one of four specializations will increase overall financial stability by increasing Z-score.

To capture other common tendencies and effects, other variables were used, such as general macroeconomic variables and some bank specific variables. To be more specific among macroeconomic variables one can find GDP growth rate, inflation rate and exchange rates. The main reason why these variables were included is to seize the influence of macroeconomic cycles. In order to add additional information some banking variables were included. Among them are cost-income ratio, assets and loans-assets ratio and income diversity indicator, which was calculated on the basis of data available in BankScope database. The calculation of income diversity indicator is based on the calculations of Laeven and Levine (2005). This indicator is important measure how much the bank is focused on activities other than just lending. Income diversity indicator is defines in the following way:

# 1-Net interest income-other operating income Total operating income

The bigger is the indicator the more banking activity is diversified. And finally to investigate deeply the effect of bank specialization, the necessary interactions of bank specialization dummy and with income diversity indicator were applied. So, the regression analysis contains a lot of variables, dummies and interactions which are expected to be good enough to answer two main questions of the research. It should be mentioned that all variables are used in regression with one year lag, because it

is often happens that most of these variables have later effect on the banks individual risks. The empiric starts with pooled ordinary least squares (OLS) and fixed effects estimates follow. In order to estimate the robustness of the received results concerning EU 27, the same regression analysis was carried out for EU 15 and for different bank groups – big and small banks.

### 5.1. Decomposition of Z-scores and Correlation Analysis

It would be very useful to describe results of the preliminary analysis of the method used – Z-score. The range which Z-score falls within is varies from -76 to 15492. This dispersion of Z-score shows high variability mostly because of outliers. Because of the outliers the sample was limited and 5<sup>th</sup> and 95<sup>th</sup> percentile were cancelled from the sample. The 5<sup>th</sup> and 95<sup>th</sup> percentiles were chosen randomly, but most empirical literature use this tails to exclude outliers in order to obtain meaningful results. So Appendixes 1 and 2 present Z-score where outliers were already excluded.

From Appendix 1 it is visible that the highest Z-score among all investigated types of bank specialization belongs to cooperative banks, followed by savings banks, which have a little smaller Z-score. This means that cooperative banks and savings banks as particular groups of financial institutions are financially stronger and more stable than any other type. This result is most probably due to the fact that the standard deviations of returns on assets of cooperative and savings banks are much lower than of other two bank types, which in turn leads to higher Z-score. It is worth mentioning that higher Z-score of savings and cooperative banks does not appear because of higher profitability (which can be approximated by return on

assets) and even vice versa – profitability of savings and cooperative banks is lower on all group levels – all banks, small banks and big banks – than that of commercial and investment banks.

The reasonable explanation for the highest Z-score of cooperative banks is the specialization of the banks itself i.e. the field of activity of cooperative banks, where the main target of cooperative bank is not to maximize profit, but to maximize customers' surplus. Since most of cooperative bank's customers are at the same time the owners of the banks, cooperative banks owners transfer the biggest share of returns to the customers, i.e. to themselves, as a consumer surplus. Thus, usually cooperative banks end up with relatively small returns on assets in nondistress period. But at the same time when there is a distress in the economy, cooperative banks use their specialization to protect themselves. They do it by not distributing the consumer surplus and use it to strengthen their positions in the market. As a consequence of such specificity of banking activity standard deviation of returns on assets is usually lower for cooperative banks.

The same is true for savings banks with the only difference that the specificity of savings bank activity implies lower return on assets and lower standard deviation of returns than these of investment and commercial banks because savings banks are organized to encourage people with few resources to save. Thus, the deposits accepted from such class of people are usually not invested in risky assets. In some countries it is even obliged by the law. So it is difficult to imagine that investment in unrisky assets will bring high returns. Hence, savings banks are usually the banks with low returns on assets and as a consequence with low deviation on returns. On the other hand as it is seen on the Appendixes 1 and 2 investment banks as a group have highest return on investment. Meanwhile standard deviation of return is very

high as well. The main reason for this is that investment banks are usually incorporated in the business of highest risk, such as foreign exchange, mergers and acquisitions and buying and selling newly issued securities, where returns are highly volatile and almost impossible to predict. Usually such type of activities is conducted in terms of high uncertainty and must be paid off by larger returns. The same is true for commercial banks which have the main objective of profit maximization. Thus they make full use of available resources investing them in riskier funds to get higher returns. It is also worth mentioning that income diversity coefficient is higher for commercial and investment banks than for savings and cooperative banks, which comes along with above arguments. The biggest bank group by the amount of assets is made up from investment banks, followed by savings. So, though commercial banks dominate by the number of the banks, investment banks dominate by their assets. Regarding the distribution of the whole bank sample for two groups big and small banks, the tendency and characteristics of basic statistics are almost the same as for the whole sample. Appendix 2 presents descriptive statistics for different bank groups in different countries. Among all selected countries, the Netherlands' banks have the highest Z-score, followed by German banks. France has the highest return on assets, and Great Britain has highest average standard deviation on assets.

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### 5.2. Empirical Estimation Results

Appendix 4 presents results for two specifications of estimation methods pooled OLS and fixed effects estimates for the z-score in EU 27 countries. To check for robustness of the results, the same two specifications of regressions were run for

EU 15 countries, the most advance in EU 27. To control for such important factor as bank size approximated by the assets the same two specifications of regressions were run again for small and big banks separately. Appendix 5 presents the results for big banks. The results for small banks are consistent with the rest of research and are available upon request. All panel regressions, for the whole sample and the EU 15, for big and small banks, include six time dummies, holding 2001 as a base period, and country dummies, keeping Germany as a base country.

## 5.2.1. General factors estimations

In terms of the macroeconomic variables, one of the most important for financial stability turned out to be inflation, which has the significant effect on the stability of the banking sector. The coefficients are of negative sign, so the increase in inflation leads to deterioration in stability. This result makes sense because balance sheets of banks are usually denominated in home currency. Thus, if inflation is high in the country of residence, then both real and nominal values of money decrease, because home currency depreciates and this leads to the worsening of balance sheet positions of banks in the country, thus banks become more predisposed to crises. The nominal interest rate<sup>4</sup> has negative effect on financial stability as well as inflation, though the effect is significant only for large banks. One can think that the higher interest rate – the price a borrower pays for the use of money he does not own – the more profitable bank. But the magnitude of interest rate has its limit; once this limit is achieved, borrowers just cannot afford loans and then overall banking activity stops, which lead in turn to financial distress. This is especially true in this

<sup>&</sup>lt;sup>4</sup> Market base rate

case for big banks because they usually make up the largest share of their profits dealing with big businesses that take large loans. So it is reasonable to assume that large scaled business will be the first one who will not be able to afford loans because interest rate is too high, compared to small banks that make up the largest share of their profit dealing with small size companies or even individuals. GDP growth does not have any significant effect on financial stability in either samples – the EU 27 and the EU 15, in both specifications and even adjusted for different bank sizes.

The assets variable in the regressions is significantly explanatory. In the sample covering both small and big banks assets are significant only in fixed effect specifications for both the EU 27 and the EU 15 and it is of expected sign. Under assets of bank one can understand everything an individual bank own: money, accounts, mortgage's stocks and bonds i.e. basically anything with a monetary value. Thus the bigger the monetary value of assets the more stable the bank is supposed to be. But it turned out that results in the full sample are driven mostly by small banks, where the coefficients for assets in both specifications are positive, rather than by the big bank sample, where these coefficients are negative. The reason for this is the so called "scale effect". Small banks can increase their assets because they have room for their extension, but big banks, having already huge assets which are sometimes hundreds time more than these of small banks, have already achieved their assets optimal size and further increase leads to inefficiency and as a result to smaller Z-score.

Another fact worth to be mentioning, concerning all bank types, though expected, is that coefficient of loans to assets ratio variable shows negative impact of that variable on the Z-score. It means that increase in loans to assets ratio will

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decrease the Z- score. This result is of expected sign because financial institutions which have large share of loans in their portfolios have higher probability to have more non-performing or problematic loans. As a consequence such intermediaries tend to be riskier. Another ratio included in the regressions was cost-income ratio. Results for this variable are significant in all the samples and all the specifications and of expected sign. The banks with high cost to income ratio have higher probability that if affected by negative shock, not to cover their costs and therefore are riskier.

#### 5.2.2. The Order of the Stability

The main aim of the present research is to give answer for two main questions, one of which is "Does one particular bank specialization type have a superior power over other types to react to distress because of the peculiarities of its sphere of activity? The answer for this question is that all the pooled regressions in the whole sample of EU 27 and EU 15 both for big and small banks suggest strong significant results that cooperative banks have the highest Z-score than any other bank type, followed by savings banks, which can be seen from the coefficient on the bank type dummy. Commercial banks are closer to default comparing to savings banks and thus having smaller probability to stay sound and not to cause financial instability, while investment banks are the most financially instable bank type, thus they show persistent inferior power over other bank types in all the specifications.

These results are similar to the results received in preliminary analysis, where the decomposition of Z-score was presented. The possible explanation for this result is that commercial and investment banks usually are engaged in riskier activities

meanwhile cooperative and savings banks have lower incentives to accept high levels of risks. For example in case of cooperative banks, since they do not care about profit maximization they do not have incentives to take on extra risk to earn extra money. Another reason for getting the highest Z-score among all other bank types can be that cooperative banks by and large are resource-intensive. It means that they usually make huge investment in the development of human capital and retail infrastructure which can be considered as inflexible sunk costs. But this high costs permit to cooperative banks to earn high returns on assets and be profitable at relatively low leverage ratios. Though resource-intensive way of doing business has vulnerabilities, in most cases in real economies it still proved to be more efficient than the resource extensive. As a result of being more efficient, cooperative banks have the higher the Z-score and the lower chance of becoming insolvent.

In the case of savings banks their field of specialization in most cases implies their activity excludes factors that would lead the rational manager of commercial bank to accept the short term horizon, because in most cases savings banks concentrate on acceptance of deposits for long periods. Another reason why savings banks are one of the most stable forms of banking activity is that due to their specialization they concentrate on lower income class of people. So in many cases government authorities regulate and monitor the activity of savings banks, not allowing them to participate in risky usage of accepted deposits.

The intuition behind the results of investment bank suggests that they tend to be the riskiest bank type due to their specialization, which focuses on investment in venture enterprises, selling and buying newly issued stocks, foreign exchange and etc and the regression analysis proves this. The significantly higher volatility of returns on assets of investment banks prevails the effect of higher capital and higher

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profits. Another possible explanation for the fact that investment banks have the highest chance to become insolvent among all other bank types is that they have the highest lending risk than any other type. Thus, the overall conclusion about the first question of concern is that cooperative and savings banks are the most financially stable intermediaries, while commercial and investment banking face the higher probability of being insolvent. This result is consistent with the hypothesis that profit maximizing banks (commercial and investment) concentrate on return activities, though this implies higher risks and as a consequence lower Z-score. Therefore the lower stability position of these banks is paid out by higher returns. Meanwhile cooperative and savings banks have both lower capital and profitability than profit maximizing banks, which both reduces the relative distance to insolvency, their lower volatility of returns more than compensates for this, resulting in an overall higher distance from insolvency.

Another variable which is very important is income diversity. The results for this variable are as well of expected sign and highly significant for large banks in both specifications, but for the whole sample the results are significant only for fixed effect specification. Usually the increase in income diversity, which can be understood as a decrease in concentration on traditional spheres of activity or markets leads to decrease in stability and risk aversion and increase in risk. This is confirmed by the present research because the sign of coefficients on the interactions of income diversity variable with different bank type dummies are all negative with the exception of investment banks, where results are insignificant. The results can be explained by the fact that savings and cooperative banks are engaged in the business in the niche of retail service. And these niches are very unique and require narrow bank specialization (savings banks are mostly engaged in deposit

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acceptance and cooperative banks concentrate on non profit maximizing activities). These are exactly narrow niches where savings and cooperative banks competitively strong and win by offering unique services. Thus, diversifying more, savings and cooperative banks risk to lose the niche where they are strong and as a consequence to become insolvent.

## **5.2.3. Bank Type Externalities**

In order to answer second question "Does the presence of a particular bank specialization type change stability of the financial system? ", one should look at how one bank type affects the financial stability of all other types. Thus mutual influence and externalities should be taken into consideration. Three main features can be traced here. Firstly, cooperative banks negatively affect other bank types' risks, because the results of interactions between bank type and cooperative banks' market share in the Appendixes 4 and 5 is strongly significant for all the specifications and samples and sizes of the bank. And again it is in the line with previous research that suggest that the existence of non – profit maximizing banks (and cooperative banks are utility maximizing type) can deteriorate the health and soundness of the whole banking system. One of the most probable reasons explaining this result is that cooperative banks "overpay" for deposits and "undercharge" for loans. This implies that having consumers who are at the same time owners is not the efficient way of dealing in banking field.

Secondly, the increase in market share of investment banks negatively affects all other bank types, which can be seen from the coefficients on the interactions between bank type and the share of investment banks from the Appendixes 4 and 5.

The possible explanation for this is that investment banks, because of their narrow specialization, can be more vulnerable to particular type of shocks, such as credit quality shock, interest rate shock or investment shock itself. For example investment banks strongly depend on two main type of income – income from the investment and selling shares, which means that investment banks tend to be highly vulnerable to interest rate changes and behavior of stock and derivatives markets. Therefore, for example, if the stock market crash occurs in the economy investment banks as a group of banks of particular specialization will be the first who will become insolvent, meanwhile cooperative banks being more diversified will suffer losses as well, but smaller relatively to investment banks.

Finally, there is a positive relationship between financial stability and the increase in the share of savings banks, which can be seen from the coefficients of the interactions between savings banks market share and bank types from the Appendixes 4 and 5. The probable reason for that the increase in market share of savings banks positively affects all other bank types increasing overall financial stability is that savings banks activity is usually solely oriented due to their specialization to accepting deposits from consumers which have fixed period of exercise. Banking practice proves that there is a possibility to transform short term deposits after the day of their exercise to medium- or long term but long term deposits are not so easily transformed to short term if at all. Therefore, the possibilities of savings banks to transform maturity from short to long make them less sensitive to short term liquidity shortage that eventually could result in bank run.

The effects of increase in the share of particular bank type on the Z-score of commercial cooperative, savings and investment per country and year were also taken into consideration. In both samples and specifications and controlling for bank

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size increase in the share of cooperative and savings banks has positive effect on Zscore, what is in line with previous findings, while the effect of increase in the share of investment banks has negative effect on Z-score on the pooled OLS specification. Unfortunately, these results say nothing about the particular effect on each bank type. It can happen, and mostly happens, that for example stronger investment sector can have different influence on commercial banks' risk than on savings bank risk.

# 6. Conclusion

The present research investigates the connection between bank type specialization and its financial stability and the stability of the whole financial system using data for the EU 27 and EU 15. Particularly, two main questions were addressed: 1) Does one particular bank specialization type have a superior power over other types to react to distress because of the peculiarities of its sphere of activity? and 2) Does the presence of a particular bank specialization type change stability of the financial system?

Thus, the main findings of this research include two main points. First, the most financially stable bank type is cooperative, followed by savings. Third position in stability belongs to commercial banks followed by investment. These findings are primarily due to the specialization of the banking activity, where cooperative and savings banks make up the first and second position in stability hierarchy due to the fact that their return volatility is lower than that of commercial and investment banks while they have lower profitability. These findings are robust in different specifications, sample size and bank size and proved by the preliminary decomposition of the Z-score.

The second result is that higher presence of particular type has different effect of other bank types. The higher the presence of cooperative and investment banks leads to decrease in Z-score of all other bank types. It can be explained by the fact that is very famous in the financial economics that the higher presence of nonprofit maximizing (in case of cooperative banks) weakens overall financial system. Meanwhile in the case of investment banks, the higher presence of them leads to deterioration of financial system because they can be subject to particular risks because of their narrow specialization. At the same time, the higher presence of

savings banks positively affects Z-score of other bank types again because of their specialization. Particularly, the ability of savings banks to transfer maturity of deposits allows them to avoid liquidity risk; thereby this bank type beneficially affects stability.

Thus, this research concludes that specialization really matters for individual financial stability of particular bank and also it is important determinant of overall financial stability of the whole system.

On the basis of this and some other research there can be investigated deeper other issues, not studied in the present research. For example such important features as the differences in the degrees of regulation of different bank specializations, difference in corporate governance at different bank types, vulnerability of different bank specialization types to different shocks and so on. There are so many interesting issues, worth to be investigated.

Other additional innovation to investigate the effect of bank specialization on individual and overall financial stability can be the usage of other techniques different from the Z-score. Examples of such models can be non-performing loans model, the so-called ZETA model and the distress probabilities model, which can employ similar analysis for determining the effect of specialization on stability in order to have comparable results. These results will enable us to determine the model which gives the most reliable results for precise forecasting of the possibility for banks to become insolvent.

Another possible modification of the present study can be to eliminate all limitations of the database and expand dataset to cover other regions, for example North America or Asia. This will allow researchers to compare results within different regions to find similarities and differences in the effects of specialization types.

It should be stressed out that the present paper is a product of ongoing studies. Therefore, when more detailed and comprehensive information will be available, some modification of the results can be done because a lot of issues must be studied further. The main point, however, is that the present research represent new cross country data to determine the effect of bank specialization on the stability. And for now it does indeed matter for bank financial stability which specialization type the bank belongs to.

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		7	Acceto	Income	DOI	SD on
		Z-Score	Assets	diversity	ROI	ROI
	Commercial	83.19	15222.8	1.18	0.58	1.12
anks	Cooperative	163.92	5896.62	0.55	0.56	0.26
All ba	Savings	144.14	4453793	0.48	0.55	0.17
	Investment	65.52	10697468	1.10	2.40	1.42
	Commercial	78.16	29458.89	0.83	0.81	0.68
anks	Cooperative	169.63	26589.95	0.56	0.66	0.27
Big b	Savings	144.28	4458282	0.48	0.55	0.17
	Investment	65.52	10691451	1.10	2.35	1.12
	Commercial	88.45	345	1.34	0.50	1.97
anks	Cooperative	162.38	295	0.54	0.33	0.26
mall t	Savings	-	829	0.14	0.11	-
آن	Investment	62.53	10694724	1.10	2.41	1.17

# Appendix 1. Preliminary analysis of the Z-score

	Bank type	Z-score	Assets	Income		Standard
Country				diversity	ROI	deviation on ROI
	Commercial	76.43	31606	0.49	0.62	1.34
GB	Cooperative	76.47	31460.6	0.49	0.34	1.34
	Savings	50.83	6616534	-	1.55	0.20
	Investment	62.85	18606422	1.34	1.55	5.76
	Commercial	50.59	17021.24	1.87	0.37	1.02
GE	Cooperative	170.48	1882.486	0.55	0.39	0.27
	Savings	172.18	2405371	0.46	0.22	0.11
	Investment	85.49	3442767	1.59	1.76	3.73
	Commercial	95.63	13982.41	0.89	0.74	0.58
ІТ	Cooperative	141.13	2263.06	0.44	0.68	0.26
	Savings	107.72	3393658	0.61	0.23	0.18
	Investment	82.34	2070591	1.34	2.19	1.45
	Commercial	49.85	23089.1	1.43	0.66	0.82
FR	Cooperative	122.80	44292.79	0.94	0.84	0.15
	Savings	54.31	10428855	0.64	1.51	0.13
	Investment	19.83	14462587	2.50	4.46	2.05
	Commercial	43.88	19607	0.27	1.56	1.46
NT	Cooperative	207.24	528459	0.45	0.35	0.03
	Savings	203.36	1430739	0.3	0.56	0.29
	Investment	23.21	6182715	0.51	0.86	0.60

Appendix 2. Preliminary analysis of the Z-score with respect to country

Data sample includes the following 27 countries of European Union for the period 2001-2007: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

To check for robustness EU 15 countries were used for the period 2001-2007: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.

Z-SCOR	Authors' calculations based on BankScope	Defined as $z \equiv (k+\mu)/\sigma$ , where k is equity capital as percent of assets, $\mu$ is average return as percent on assets, and $\sigma$ is standard deviation of return on assets as a proxy for return volatility. Measures the number of standard deviations a return realization has to fall in order to deplete equity, under the assumption of normality of banks' returns.
LOGASSESTSLAG	BankScope	Logarithm of total assets for each bank (in million USD) lagged by 1 year
LOANS_ASSETSLAG	BankScope	Ratio (%) of loans over total assets lagged by 1 year
LOGINFLATIONLAG	IMF	Logarithm of inflation rate lagged by 1 year
LOGINTRATELAG	IMF	Logarithm of nominal long-term interest rate lagged by 1 year
GDPLAG	IMF	Growth rate of nominal GDP lagged by 1 year
COST_INCLAG	BankScope	Ratio (%) of cost over income lagged by 1 year
INCDIVLAG	Authors' calculations based on Laeven and Levine (2005) and BankScope	1- Net interest income-other operating income Total operating income
COOPSHARELAG	Authors' calculations based on BankScope	Market share of cooperative banks in a country per year lagged by 1 year
INVSHARELAG	Authors' calculations based on BankScope	Market share of investment banks in a country per year lagged by 1 year
SAVSHARELAG	Authors' calculations based on BankScope	Market share of savings banks in a country per year lagged by 1 year
D_COOPERATIVE	Authors' calculations based on BankScope	Cooperative bank dummy - equals 1 for cooperative banks and 0 otherwise.
D_SAVINGS	Authors' calculations based on BankScope	Savings bank dummy - equals 1 for savings; 0 otherwise.
D_INVESTMENT	Authors' calculations based on BankScope	Investment bank dummy - equals 1 for investment banks; 0 otherwise.

Variable	EU 27 Pooled OLS	EU 27 Fixed	EU 15 Pooled OLS	EU 15 Fixed
D_COOPERATIVE	12.537		29.980	
D_INVESTMENT	(3.39)*** -75.316 ( 2.65)***		(1.70)* -47.182 ( 2.60)***	
D_SAVINGS	(-3.63) 25.503 (3.01)***		(-2.09) 12.768 (5.39)***	
INCDIVLAG	-0.119	-0.212	-0.112	-0.212
COOPSHARELAG	(-1.39) 121.270 (4.2)***	(-4.05)*** -55.724 (-0.23)	(-1.33) 96.812 (2.51)***	(-4.05)*** 308.414 (1.14)
INVSHARELAG	-85.549 (-4 03)***	-56.516 (-1.64)*	-81.745 (-3.97)***	-129.883
SAVSHARELAG	61.938 (6.77)***	-11.774	82.474	-88.028
LOANS_ASSETSLAG	-0.078	-0.082	-0.072	-0.073
COST_INCLAG	(-5.00) -0.096 (-11.91)***	(-2.90) -0.119 (-54 10)***	(-2.57) -0.098 (-11.41)***	(-3.95) -0.121 (-60.23)***
LOGASSETSLAG	0.173	0.372	0.113	0.367
GDPLAG	(1.04) 0.250	(3.94)***	(0.65) 0.245	(3.97)***
LOGINFATIONLAG	(0.71) -14.573	(-1.02) -29.289	(0.55) -15.521	(-1.28) -31.182
LOGINTRATELAG	(-2.05) -3.921 (1.21)	(-0.57) -1.120	(-1.31) -4.621 ( 0.98)	(-3.86) -6.130 ( 4.26)***
INCDIVLAG*D_COOPERATIVE	-3.688	-2.858	-3.504	-3.058
INCDIVLAG*D_INVESTMENT	(-1.98) <sup>***</sup> -1.327	(-1.50) -0.719	(-1.85)" -1.327	(-1.66)" -0.672
INCDIVLAG*D_SAVINGS	(-1.89) <sup>**</sup> -7.344	(-1.41) -7.415	(-1.83) -6.783	(-1.25) -6.819
COOPSHARELAG*D_COMMERCIAL	(-2.25) <sup>***</sup> -13.596	(-2.10)*** -13.941	(-2.44)	(-2.13)*** -14.959
COOPSHARELAG*D_INVESTMENT	(-4.59)*** -7.556	(-2.88)*** -4.650	(-3.67)*** -5.304	(-1.70)** -8.233
COOPSHARELAG*D_SAVINGS	(-7.80)*** -2.253	(-2.26)** -3.252	(-7.07)*** -1.220	(-3.22)*** -0.376
INVSHARELAG*D_COOPERATIVE	(-7.46)*** -4.701	(-4.61)*** -5.234	(-3.15)*** -5.504	(-2.83)*** -8.677
INVSHARELAG*D_SAVINGS	(-6.55)*** -1.565	(-3.65)*** -2.193	(-3.75)*** -4.213	(-6.12)*** -2.614
INVSHARELAG*D_COMMERCIAL	(-5.27)*** -7.551	(-7.98)*** -5.574	(-6.68)*** -8.604	(-8.78)*** -5.135
SAVSHARELAG*D_INVESTMENT	(-3.85)*** 0.199	(-4.86)*** 0.687	(-2.69)*** 1.173	(-4.41)*** -2.595
SAVSHARELAG*D_COOPERATIVE	(6.48)*** 1.706	(3.04)*** 1.240	(6.78)*** 3.496	(2.76)***
SAVSHARELAG*D_COMMERCIAL	(1.88)* 5.424 (1.24)*	(2.19)** 3.178	(1.54) 1.387	(3.48)*** 9.456
R-squared Observations	(1.81)^ 0.120 37501	(2.165)^^ 0.124 32626	(5.58)^^^ 0.111 35343	(2.9)^^^ 0.112 30754

Appendix 4. Regression results for the whole sample of banks

p values in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Variable	EU 27 Pooled	EU 27	EU 15 Pooled	EU 15
	OLS	Fixed	OLS	Fixed
D_COOPERATIVE	17.514		26.130	
D INVESTMENT	(3.99)*** -35.079		(2.04)** -37.027	
_	(-1.59)		(-1.96)**	
D_SAVINGS	13.766 (1.74)*		11.726 (5.16)***	
INCDIVLAG	-0.218	-0.231	-0.212	-0.237
COOPSHARELAG	(-10.54)*** 135.156	(-22.01)*** 220.751	(-9.37)*** 128.495	(-22.82)*** 78.241
	(3.77)***	(1.17)	(1.7)*	(3.28)***
INVSHARELAG	-31.331 (-1.38)	-28.923 (-0.77)	-53.278 (-0.63)***	(-1.01)
SAVSHARELAG	49.659	-14.527	54.744	-104.913
LOANS ASSETSLAG	(5.36)***	(-0.54) -0.172	(4.21)**** -0.145	(-0.92) -0.159
	(-9.165)***	(-25.85)***	(-8.22)***	(-23.86)***
COST_INCLAG	-0.086 (-8.31)***	-0.112 (-19.93)***	-0.085 (-8 22)***	-0.114 (-26 49)***
LOGASSETSLAG	0.363	-0.341	0.498	-0.413
	(1.53) -0 158	(3.21)*** -0 129	(2.06)** -0 312	(3.45)*** 0.039
	(-0.35)	(-0.38)	(-0.57)	(0.09)
LOGINFATIONLAG	-11.424 (-1.32)	-25.183 (-3.42)***	-14.128 (-1.19)	-20.119 (-2 35)**
LOGINTRATELAG	-7.274	-8.331	-7.217	-15.581
	(-1.97)** -2.490	(-4.23)*** -2 400	(-1.41) -3 375	(-7.31)*** -/ 891
	(-1.75)*	(-2.63)***	(-2.09)**	(-2.38)***
INCDIVLAG*D_INVESTMENT	-0.901	-0.350	-0.957	-0.261
INCDIVLAG*D SAVINGS	(-1.43) -7.025	(-0.84) -6.759	(-1.46) -6.525	(-0.58) -6.415
	(-2.24)**	(-2.18)**	(-2.40)***	(-2.23)**
COOPSHARELAG^D_COMMERCIAL	-17.845 (-4.03)***	-10.979 (-1 78)*	-12.542 (-2 48)***	-11.411 (-2 29)**
COOPSHARELAG*D_INVESTMENT	-2.169	-5.875	-8.235	-6.200
	(-2.15)** -3.410	(-1.92)** -2.037	(-4.96)*** -1 21 <i>4</i>	(-3.18)*** -1 554
	(-6.27)***	(-2.27)**	(-1.86)*	(-2.81)***
INVSHARELAG*D_COOPERATIVE	-2.463	-4.133	-4.613	-6.545
INVSHARELAG*D_SAVINGS	(-2.47) -6.308	-4.402	-5.280	(-4.39) -2.907
	(-3.11)***	(-2.27)**	(-6.43)***	(-1.17)
INVSHARELAG <sup>*</sup> D_COMMERCIAL	-9.064 (-1.32)	-6.383 (-4.17)***	-3.935 (-1.91)*	-7.072 (-4.25)***
SAVSHARELAG*D_INVESTMENT	1.967	3.876	1.098	1.323
	(3.75)*** 1 654	(2.55)*** 1 081	(2.48)*** 2.023	(2.10)** 1 895
	(3.24)***	(5.29)***	(4.97)***	(5.06)***
SAVSHARELAG*D_COMMERCIAL	5.119	6.777 (2.33)**	9.428	8.905
R-squared	(2.09) 0.176	(2.33) 0.179	0.171	0.172
Observation	18532	15835	17534	15023

Appendix 5. Regression results for the big banks only

p values in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%