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Too Big to Fail or Too Big to Save?

Evidence from European bank equity prices from 1987 – 2012.

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Abstract:

In this thesis the determinants of market-to-book ratio on European banks from 1987 - 2012 is analyzed with focus on determining whether European banks are under a too-big-to-fai protection, or if they are too big to save. The thesis argues that European banks on average trades with a relative premium due to too-big-to-fail protection, and that the largest and most systemic banks are priced lower than its less systemic peers, possibly through being too big to save. This tendency is strengthened in the years after 2008. These results are found by implementing the empirical approach introduced by Demirgüç-Kunt and Huizinga (2012) on my dataset of bank- and country-specific variables on European banks from 1987 - 2012.

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Chapter 1: Introduction

After the 2008-2009 financial crisis several of the largest European banks have reduced their size, after almost 20 years of growth. This reduction in size might be as a result of the banks had grown too large for the government authorities to be able to save them in time of crisis. Such too-big-to-save episodes were seen in the 2008 crisis, with the failure of the Icelandic banking industry in 2008 and more recently the restructure of Cyprus banks as examples. Are European banks too big to fail or too big to save? This thesis analyses the determinants of equity pricing on European banks, to find evidence about the banks' status as either too big to fail (TBTF) or too big to save (TBTS). I use OLS regressions in my analysis of market-to-book ratio on 141 European banks, determined by bank- and country-specific variables. The methodology follows the framework by Demirgüç-Kunt and Huizinga (2012). See Appendix 2 for detailed list of variables used and its sources.

To determine whether a bank is important enough to get rescued in time of crisis, the term systemic is used. This thesis uses bank liabilities as a share of country GDP as a measurement of how systemic the bank is. This approach is consistent with Demirgüç-Kunt and Huizinga (2012), and others (see for instance: Völz and Wedow 2011). Barth and Schnabel (2013) argue for the use of delta-CoVar analysis as presented by Adrian and Brunnermeier (2011) when determining which banks are systemic. The method seeks to identify which contribution a single bank has on the greater systemic risk. Brown and Dinc (2011) analyses the concept of "Too Many to Fail". Stern and Feldman (2009) define big in TBTF as: "banks that play an important role in the country's financial system and its economic performance" (Stern and Feldman 2009:12). Barth and Schnabel (2013) use the word systemic instead of big, as in "Too Systemic to Fail".

In a situation where a bank is being stressed by losses on its balance sheet, and the overall value of its assets is less than its liabilities, government has more or less two opportunities; either to let the bank file for bankruptcy and be exposed to the costs with a failing bank, or take the cost of saving the bank. It is usually very difficult to disclose the costs of either the two alternatives, as a bank balance sheet often is complex and contains a significant amount of illiquid and intangible assets. Banks are also widely integrated through the interbank lending markets, and a failing bank could immediately cause problems for the bank's counterparties. Usually banks

have between 5-9 % of its total assets in liquid assets, which leaves it very exposed to losses. This makes banking a fragile industry, and a big bank failing could also lead to a crisis of confidence in the financial markets as a whole (Mishkin 2006). This situation is known as an information crisis, due to lack of information on counterparty exposure being the main reason for the unwillingness of lending out money.

All elements put together, it is quite clear that politicians and the government agencies is in a very delicate situation when deciding whether the bank is to be saved or not. History shows that in most cases when a bank is near failure the authorities steps up and saves the depositors, creditors, and sometimes even the owners (Stern and Feldman 2009). Because the common practice is saving rather than failing, large banks are commonly thought to have a too-big-to-fail protection. It can be seen as a dilemma between two evils, were the authorities have to choose between having a bankruptcy with uncontrolled implications and third-party costs to the economy as a whole, or a more controlled bailout, although with unknown ultimate direct costs and high long term indirect economic costs because of strengthening moral hazard.

This thesis finds evidence suggesting that most banks with systemic size greater than 0,1 contains a market-to-book premium compared to less systemic banks. And evidence indicating less or no premium on banks who reach systemic size greater than 1. And lastly evidence suggesting a too-big-to-save discount in market-to-book-ratio in the years 2008-2012 for banks with systemic size greater than 1.

Chapter 2 presents background and theory regarding TBTF, with relevant examples from the recent financial crisis. Chapter 3 presents the variables I use in the regressions, with explanations on its' relevance as determinants, followed by a presentation of key issues in the methodology. Chapter 4 is dedicated to summary- and descriptive statistics from my dataset. Chapter 5 contains the empirical results, with analysis of its relevance to the discussion on TBTF versus TBTS, followed by robustness checks on the results. Chapter 6 includes a short summary of the analysis in chapter 5, followed by concluding words and final thoughts.

Chapter 2: Background and theory

In this chapter I first present logic about why banks are important, and why that importance might lead to a systemic status with a too-big-to-fail protection from the authorities. Further I explain why banks would want to grow large, and discuss how big the problem of TBTF is today, and how some banks might have turned too big to save. At the end I present a quick résumé of TBTF-related events in the recent global financial crisis, and explain the increasingly important role of central banks.

2.1 Banks are important

Banks have an important role in modern economies, providing a vital service both for companies and private households. The idea that banks sometimes are too important to file for bankruptcy is a widely accepted hypothesis. This is usually spelled 'Too Big to Fail', implying that banks are too big for the government not to intervene if the bank is on brink of failure. Main factors contributing to banks' special systemic status is:

A) Banks are the largest lenders to businesses and households, and consequences of a bank failure will most likely result in harsher conditions for the companies and households who seek financing, due to lost information-capital in the failing bank (Mishkin 2006, Ashcraft 2004). Banks also affecting households and companies through its lending practice; is money available for households and companies, and at what price? One important escalating factor in the recession springing from the 2008-2009 financial crisis was bank tightening their lending businesses, making it hard for companies and households to finance even economically sound investments.

Figure 2.A – Net percentage of banks tightening lending standards.

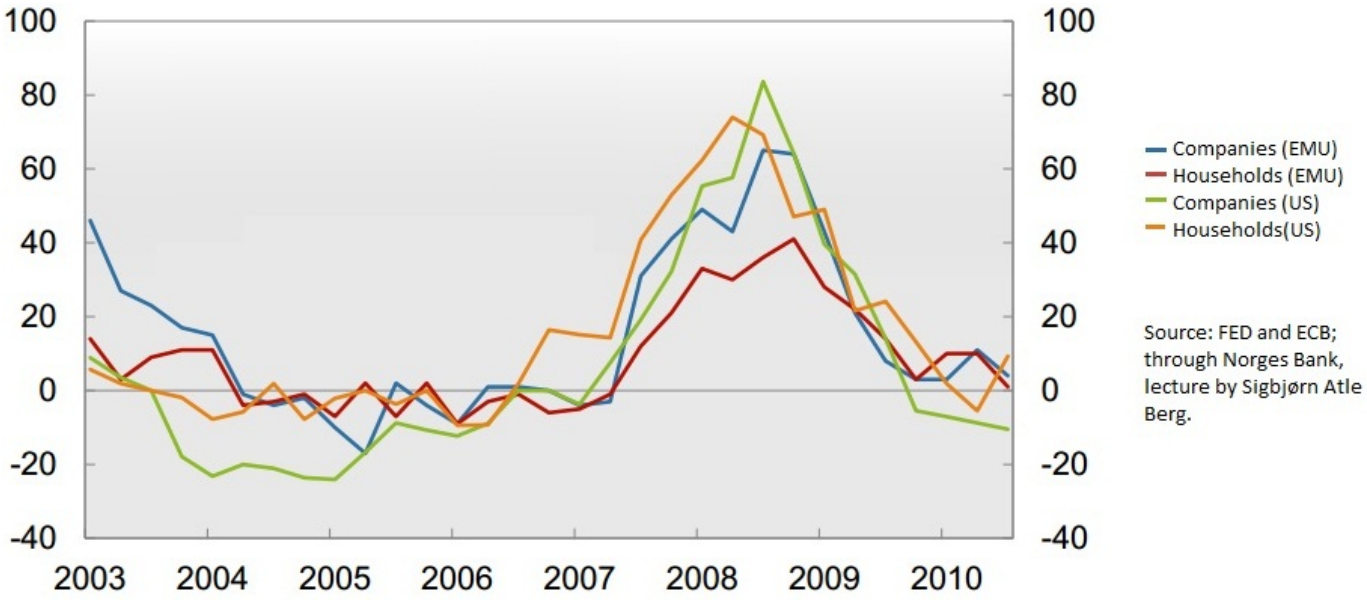


Figure 2.A shows how banks in the European Monetary Union (EMU) tightened its lending in the years from 2007. Banks are required to hold a specified capital ratio due to regulatory requirement and to maintain creditworthiness. When faced with increased losses like in 2007-2008, banks need to either raise new capital by issuing new equity or debt, or to gradually build up new capital by not lending out more money. The latter option is often the most rationale solution for banks; which is observed in figure 1. Banks tightening lending in fear of worse economic times could also be a self-fulfilling prophecy, possibly triggering fall in house-prices and less employment, which again triggering increase in bank losses.

B) Bank deposits and savings accounts are a large share of a country's money supply, which in times of crisis would cause a decline in money supply if scared depositors were to take out their money from banks (Kaufman 1996). Many banks also provide vital parts of a countries payment-system (Kaufman 1996).

C) Banks are connected to each other in many ways; through interbank lending, derivatives exposure, interbank counterparties in trades, and mutual ownership in subsidiary companies. This interconnection between banks should be an important factor giving banks the special status; As if one bank files for bankruptcy it will spread fear in financial markets on which other banks having direct or indirect exposure to the failing bank (Kaufman 1994 and 1996). One recent example of such fear can be found in the aftermath of Lehman Brothers filing for

bankruptcy September 2008, when fear spread of which banks had exposure to Lehman Brothers.

Table 2.A

List of banks with systemic size >0,5 in 2011	Systemic size	Country
BANCO COMERCIAL PORTUGUES SA	0,5213	Portugal
BBVA	0,5244	Spain
UNICREDIT SPA	0,5518	Italy
SOCIETE GENERALE GROUP	0,566	France
STANDARD CHARTERED PLC	0,586	United Kingdom
LLOYDS BANKING GROUP PLC	0,6094	United Kingdom
ERSTE GROUP BK AG	0,6478	Austria
SVENSKA HANDELSBANKEN	0,6672	Sweden
KBC GROUP NV	0,7263	Belgium
DNB ASA	0,7382	Norway
BANK OF GREECE	0,7793	Greece
DEUTSCHE BANK AG	0,8136	Germany
CREDIT AGRICOLE SA	0,8386	France
HSBC BANK MALTA PLC	0,8494	Malta
BANK OF IRELAND	0,9097	Ireland
BNP PARIBAS	0,9414	France
ROYAL BANK OF SCOTLAND GROUP	0,9437	United Kingdom
BANK OF VALLETTA LTD	0,9568	Malta
BARCLAYS PLC	0,9882	United Kingdom
BANCO SANTANDER SA	1,099	Spain
CREDIT SUISSE GROUP	1,718	Switzerland
NORDEA BANK AB	1,761	Sweden
ESPIRITO SANTO FINANCIAL GRP	1,816	Luxembourg
DANSKE BANK AS	1,851	Denmark
CYPRUS POPULAR BANK PCL	1,867	Cyprus
BANK OF CYPRUS PUBLIC CO LTD	1,973	Cyprus
UBS AG	2,32	Switzerland
HSBC HLDGS PLC	2,511	United Kingdom

This table shows banks with liabilities as a share of GDP that exceeds 0,5, namely systemic size >0,5. Country is the country where the banks headquarter lies. Data is from European banks in 2011.

In most modern economies the government provides a safety net to prevent banking panics, which can be seen as evidence that banks do possess a special status in the economy. By guaranteeing for some of the deposits, usually up to a fixed amount per savings account, it is removing a disciplining factor in the bank. A bank in a country with no safety net for depositors would have to hold more capital in case of a bank run, compared to a bank in a country with a safety net (Mishkin 2006). Bank safety net is usually split into one official part, which typically contains a version of deposit insurance, and an unofficial or implicit part. The

unofficial safety net is where TBTF protection lies; an implicit guarantee by the authorities to bank liability-owners that the bank will not go bust. This happens because the authorities are afraid of the consequences of letting a bank file for bankruptcy, I will discuss this more in detail in subsection 2.3.

2.2 Why banks pursue size

Banks have incentive to endeavor status as a systemically important bank so that the bank is able to claim additional protection through the implicit safety net, incentives to become 'Too Big to Fail'. Banks will try to grow larger, to get more complex, and to be more involved with other banks. In the years before the financial crisis of 2008-09 the big banks grew larger than the economy (see fig. 2.C at page 11 for an illustration of this) consistent with the incentive of becoming more systematic. Further I will explain shortly the dynamics of banks being able to increase their size and exposure when they hold TBTF protection through the implicit safety net.

The key factor in determining what creditors charge for their money is the probability of not getting their money back, for instance due to a bankruptcy. Because of lower risk of default creditors would accept a lower rate of return on its capital to TBTF banks (Stern and Feldman 2009). Banks with status as TBTF are encouraged by relative cheaper cost of capital to increase their activities. This is a misallocation of capital, as the TBTF banks operating on a larger scale of activity, and non TBTF-banks have incentives towards reaching TBTF status.

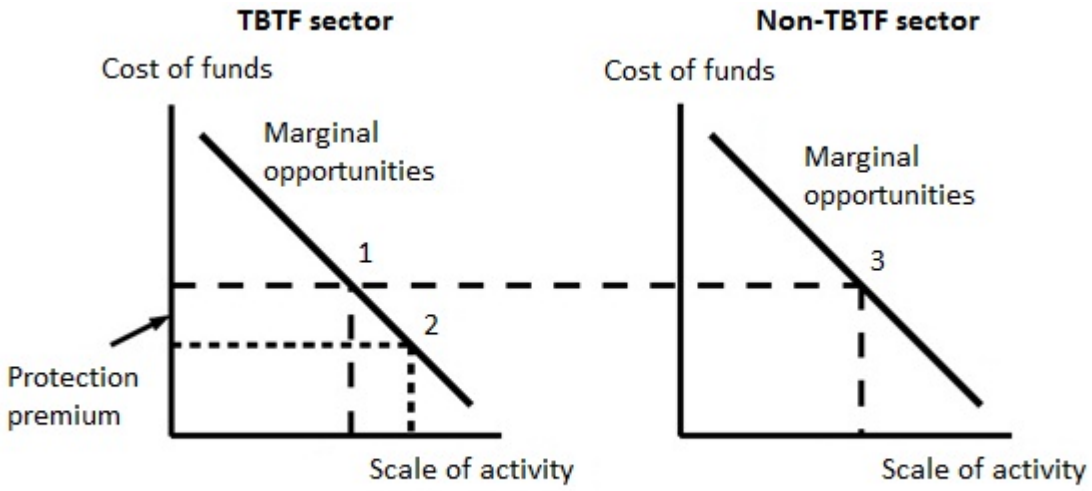


Fig. 2.B shows the increased activity from 1 to 2 due to cheaper capital available, the misallocation of capital into banking is represented by the alternative position 3 in the Non-TBTF

industries. Incentives are skewed for banks to be covered of the unofficial safety net through gaining TBTF protection, so they can achieve cheaper capital.

There is also other reasons for banks growing in size, as some parts of modern banking have a greater scale of economics than traditional banking, for example securitization of assets. But even though there are legitimate reasons to grow large, it is likely that banks have grown this large also due to management see their importance and compensation increase with bank size (Demirgüç-Kunt and Huizinga 2012).

2.3 How big is the problem of TBTF?

The main reason for TBTF is creditors expecting to be saved by the authorities if the bank fails, even if the policymakers and controlling agencies state in normal times that they will not step up for non-insured deposits and creditors. Policymakers have regularly stated that banks should not count on being rescued if on the brink of failing, however history shows that in some way banks and financial institutions do get saved when close to failure. The difference between what policymakers and regulatory authorities say they will do, and what they actual do is a time-inconsistency problem. There is an obvious lack of credibility in the policymaker's consistency towards holding long-term economic benefits above the short-term costs of letting a bank file for bankruptcy. Stern and Feldman (2009) are drawing a link between this time-inconsistency and credibility problem with the time-inconsistency and credibility problems in monetary policy discussed extensively in economics, (see for instance Kydland and Prescott 1977).

Since it is hard to accurately quantify the value or size of TBTF, the logic of time-inconsistency is central in understanding that TBTF still is a problem in the economics of banking and finance, even though it is almost 30 years since Congressman McKinney used the expression "Too Big To Fail" during the inquiry into a large bank rescue in the Unites States in 1984 (Conover, 1984:288). Stern and Feldman's understanding of TBTF implies that changes in deposit-guarantee or other safety-net policy changes will not have effect on the TBTF, since unsecured creditors still believe they will be rescued when on the brink of failing.

Stern and Feldman (2009) are focusing on three main developments in banking and finance who each increasing the extent of banks being recipients of TBTF protection. The criteria is originally from 2004, but I find them just as relevant in today's banking.

1. Increased concentration on banking assets: The big banks have grown even bigger during the 90's and early 00's mostly by big mergers and acquisitions. While during the finance crisis of 08-09 we saw a number of failing banks being bought by rival banks with backup from the authorities. One example is the creation of Bankia in Spain, which consisted of a number of failing medium sized savings- and loan banks. Banks growing even bigger in absolute terms, and compared to its country's economic size most likely have strengthened creditors' view of being under TBTF protection.

2. Greater complexity of banking operations and activities, increasingly important in the payment system: Financial innovations and technology development have made the few largest banks increasingly important to the payment-related activities. Securitization, derivatives and off-balance sheet activities makes the banking more complex, which increases the uncertainty when trying to do a cost-benefit analysis of saving or not saving the bank. Increased complexity most likely also increases creditor's expectation of TBTF protection.

3. Several policy decisions, such as highly visible government bailouts: Financial crisis increased in frequency the last 40 years and with it, large bank bailouts. In the recent financial crisis and economic downturn from 2008 -2012 many TBTF banks have been rescued wholly or partly by the authorities. Some interesting cases come later in this chapter. TBTF protection is renewed to creditors who on a regularly basis get confirmed that the authorities stepping up when a bank is close to failure.

2.4 Banks growing too large?

In light of the recent financial crisis there has been renewed focus on an alternative view on authorities being able to save its financial institutions, namely the topic of 'Too Big to Save', TBTS. A country's ability to rescue a failing bank depends mainly on two factors; the size of the bank and the country's overall economic and financial situation. In the last 5 years both circumstances have pulled towards less capability to rescue banks; bad banks have been merged or acquired by larger and better banks, public finances in many countries have continued to deteriorate in the years following the crisis of 08-09.

Demirgüç-Kunt and Huizinga (2012) states that under normal business cycle conditions banks probably could have strengthened their TBTF protection, but in light of the economic downturn

and increasing debt levels of governments, it is not sure anymore if a country is able to cover for its largest banks. Financially strapped governments are also under a large public pressure of not spending hard-earn taxpayer money on big banks, which in that case TBTF protection is swapped for TBTS status. Later this question will be analyzed empirically on European banks.

Barth and Schnabel 2012 gives a brief overview of some papers covering the topic of TBTS, which has been analyzed much less than its brother; TBTF. One prime example of TBTS in the recent years is Iceland; its three banks was almost 10 times Icelandic GDP, whereas Iceland could never have guaranteed for all the unsecured deposits and liabilities to creditors when the banks failed in October 2008. Another example is the Irish government guaranteeing for all bank liabilities, both unsecured deposits and creditors. This had a huge effect on Irish public finances, as it went from being the least indebted nation in EU to one of the worst with >100% debt-to-GDP ratio (Martin and Waller 2012), peaking 120% debt-to-GDP ratio in 2013(Reuters 27.04.2012).

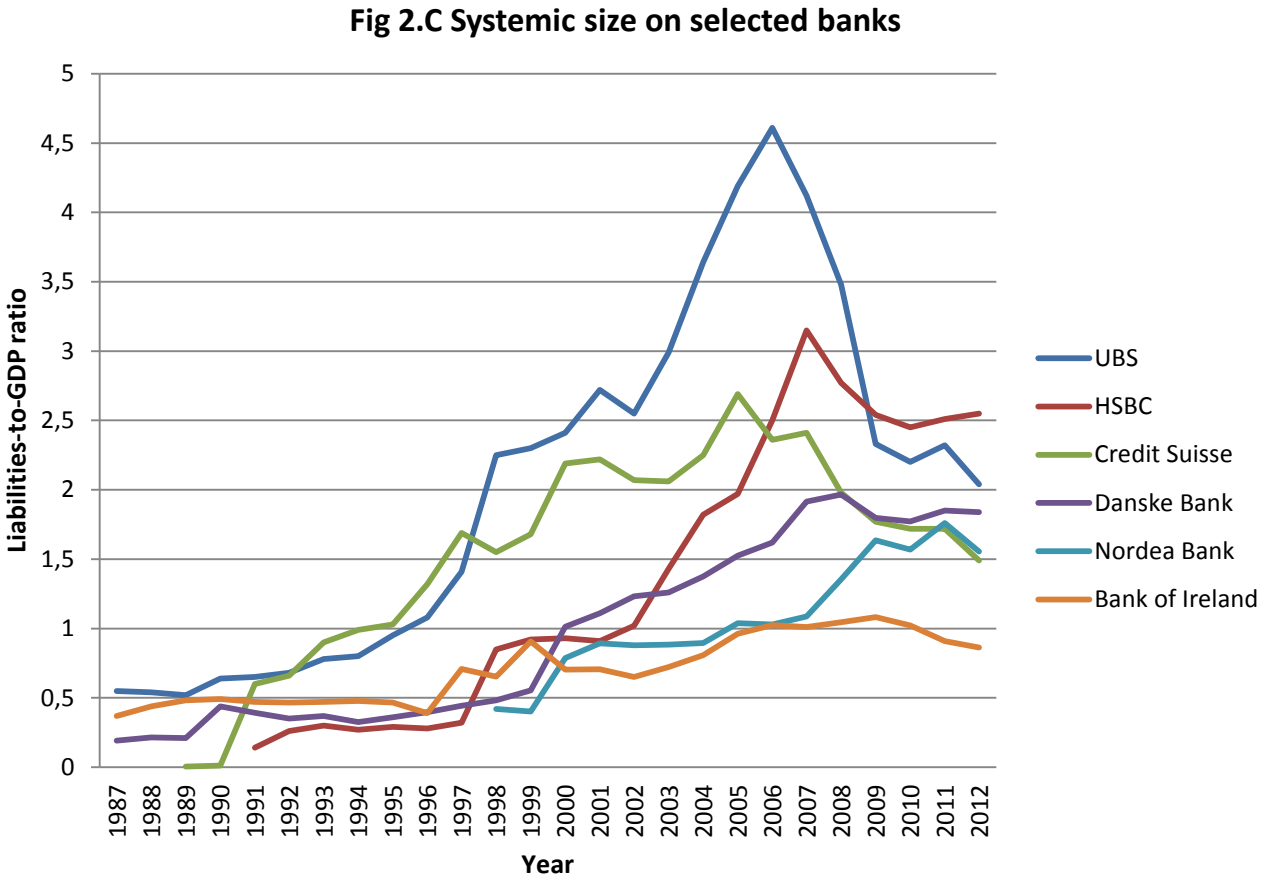


Figure 2.C: Liabilities-to-GDP ratio for 5 of the largest banks in my dataset in 2012, and Bank of Ireland.

Figure 2.C illustrates the vast growth in large European banks in the years leading to the financial crisis.

2.5 TBTF-related events in 2008-2012

In this subsection I will give a quick presentation of some important events during the recent financial crisis that most likely had an effect on creditor's consciousness of being under a TBTF protection or not. In light of my analysis of whether banks are TBTF or TBTS, I find it interesting to underline a few and very important related events in the recent financial crisis. I will present small comments at each event, and some final thoughts in the end.

Nationalization of Northern Rock – 18.02.2008: The bank was eventually nationalized on Sunday 18.02.2008 after struggling with heavy losses on American subprime mortgages. As early as September 2007 it received extended loans from The Bank of England, and guarantees from the Minister of Finance Alistair Darling, that all deposits were safe. Northern Rock was one of Britain's largest lenders, and most likely had status as TBTF; quoting John McFall, MP and UK Treasury Select Committee: "The fact that the Bank (Bank of England) is willing to act should be reassuring." (BBC 13.09.07). It is easy to understand that depositors and creditors in other British banks understand this as having TBTF protection.

JP Morgan buys Bear Stearns – 16.03.2008: In a deal orchestrated by the FED, JP Morgan bought Bear Sterns after a run on the investment bank. Bear Stearns was unable to get liquidity in the financial markets, and asked the FED for a loan (New York Times 17.03.2008). However the FED arranged a deal with JP Morgan buying Bear Stearns, with guarantees on FED buying $29 billion of toxic assets off Bear Stearns balance sheet (Wall Street Journal 16.03.2009). The FED Chairman Ben Bernanke later stated under the congressional hearing that they were afraid of a "chaotic unwinding of investments in the U.S. economy" (Bloomberg 02.04.2008). Bear Stearns was seen as one of the most ruthless investment banks on Wall Street, and by being saved contributing to the overall impression of TBTF protection of big bank creditors.

Bankruptcy of Lehman Brothers – 15.09.2008: Lehman Brothers, at the time fourth largest investment bank in the U.S., filed for bankruptcy protection 15.09.2008, after failing to reach an agreement orchestrated by the FED for being bought by Barclays PLC or Bank of America (New York Times 14.09.2008). The financial markets plummeted the following days, and investment

banks were effectively stripped of their TBTF protection (Economist 15.09.2008). Failure of Lehman Brothers was in many ways the defining moment of the subprime crisis evolving to a systemic financial crisis, since the widespread impression of the financial markets was that no major financial institution would be allowed to file for bankruptcy (Baldwin, 2009: 9).

Nationalization of UK banks: All UK banks but two (HSBC and Barclays) received bailouts and was partly nationalized in the recent financial crisis (Telegraph 13.10.2008). Especially Royal Bank of Scotland had to be rescued in a spectacular injection of new capital by the finance ministry, as well as an injection of capital in the newly merged 'superbank' named Lloyds Banking Group made out of HBOS and Lloyds-TSB (Daily Mail 13.07.2009). Stockowners were diluted by the injection of capital, where the state as of June 2013 owns 82% of RBS and 40% of Lloyds TSB. No losses to creditors most likely fueled the impression of TBTF protection.

Long Term Refinancing Operations and ECB Bank rescue packages: The European Central Bank (ECB) introduced cheap credit to banks through an extension of their refinancing program LTRO (Financial Times Lexicon 2013). Credit was offered at 1% at 3 years maturity in December 2011 and February 2012, where 523 and 800 banks lent respectively €489bn and €529,5bn from the central bank. Banks were now able to post mortgage-backed-securities, sovereign bonds and other commercial paper as collateral for the cheap loans. €325bn euro went to banks in troubling countries such as Greece, Ireland, Spain and Italy (Guardian 29.02.2012). In August 2012 ECB launched Outright Monetary Transactions (OMT), a program set to directly buy sovereign bonds from troubling countries. These operations had huge impact on the European banking industry, and can easily be presumed as a 'bailout' of banks, probably strengthening TBTF impression in Europe.

Summary of 2.5

Both TBTF and TBTS episodes were present in the recent financial crisis, however in most occasions it seemed as the authorities preferred to save the troubling bank. In the clearest TBTS case with Icelandic banks, the authorities really did not have any other alternatives. Failure of Lehman Brothers was obviously a shock to both creditors and policymakers; creditors were shocked about being stripped of TBTF protection, while policymakers were shocked about the consequences of letting Lehman fail. Through the crisis the UK have rescued almost its entire

banking system, completely shielding creditors, which might be the clearest signal of existing too-big-to-fail protection.

2.6 The increasingly important role of central banks

Through the financial crisis the central banks played an ever increasingly important role in managing the financial markets. Efforts like lowering interest rate to record lows, open market operations such as quantative easing (QE) and OMT, extensive lending in central bank discount window and official statements made. Mario Draghi stated in July 2012 when introducing OMT that he would "do whatever it takes" to help Europe from the financial crisis (Economist 08.06.2013). As recently as 9th June 2013 a spokesman for ECB stated that "There is no limit to the ECBs bond-buying program" (Reuters 09.06.2013). In the US Ben Bernanke have underlined that QE will be continued until a specified unemployment-rate is reached. Central banks have most likely become important players in whether or not creditors believe they are under a TBTF protection or not. Consistent with research by Altunbas, Gambacorta and Marqués-Ibáñez (2010) argues that easy monetary policies affect banks in taking greater risks.

Chapter 3 – Variables and methodology

In this chapter I present the bank-specific and country-specific variables I use in the regression analysis, with explanations of its relevance as determinants of my endogenous variable market-to-book ratio. I follow the same methodology as Demirgüç-Kunt and Huizinga (2012), with some adjustments on variables which will be commented on.

3.1 Market-to-book

In my analysis of 'too big to fail' versus 'too big to bail' I use Market-to-book ratio as my endogenous variable in the regressions. Market-to-book ratio also known as Price-to-book ratio is the ratio of a firm's market capitalization to the book value of shareholders equity (Berk and DeMarzo 2007:26). The ratio is indicating whether investors are willing to pay more or less for the firm, than its balance sheet indicates what the firm is worth. If a ratio exceeds one, it is a signal that investors think the firm is able to create value of the firm's assets which exceeds the liquidation value. However a market-to-book ratio is also affected by other non-firm-specific variables such as inflation (Brealey, Myers and Allen 2011:120). How the balance sheet is reported would also affect the Market-to-book ratio, for example if a company has a lot of intangible assets not reported in the balance, the firm would come out with very high ratio, reflecting that the actual assets in the firm is higher than the assets reported in the balance sheet. In light of this it is clear that there will be huge differences between industries, reflecting for instance if the industry is highly capital intensive, or has most of its assets through human capital or other intangible assets. For example a consultancy firm versus a railroad company; whereas the consultancy firm's only assets are the office building, compared to the railroad company owning whole railroads, trains and train-stations.

There are obvious problems of using market-to-book ratio when setting the value of a single firm, or when comparing firms in different industries; however it is quite useful as a tool for comparing firms in the same industry. In European banks the average market-to-book ratio was 0,74 in January of 2013, while in the US banks the same ratio averaging on 0,98 (Damodaran 01.2013), perhaps indicating that investors believe many of the assets in European banks are worth less than in US banks. A reasonable explanation could be that European banks are more

exposed to countries with severe public economy problems, reflecting expected write-downs of the bank's assets.

Another explanation is that European banks are priced lower because of the authorities being less able to step up and rescue the banks if failure, or with other words; the too-big-to-fail protection is less worth in Europe than in the US. Or the other side of the same solution; that European banks have gained too-big-to-save status. I will focus on these questions in my regressions later, where market-to-book ratio is the dependent value.

3.2 CDS – credit default swap

In addition to Market-to-book, Demirgüç-Kunt and Huizinga (2012) uses CDS as dependent variable explained by the same explanatory- and control variables. CDS is thought to be relevant in determining whether the bank is TBTF or TBTS as the price of the CDS reflects bondholders expected loss. CDS can be seen as insurance for bondholders against not receiving par value on their bonds at maturity, the seller guarantees repayment on the nominal amount insured, and the buyer pays an annual premium for the insurance. The premium is often known as the CDS spread, expressed in basis points of the par value (Eliassen 2010).

In my analysis I will not include CDS due to limited access on data. CDS is traded over-the-counter on different bond maturities, and with different restructuring clause. In Demirgüç-Kunt and Huizinga (2012) they have less than 5% the amount of observations on CDS observations than Market-to-book. Through NHH I could only access 5 years of data on a handful of my banks, hence I got to the conclusion not to include CDS as dependent variable in my analysis.

3.3 Explanatory variables

Bank liabilities and its property of measuring systemic size: In measuring how important a bank is to its home-country I use the term systemic, and I measure systemic size by dividing the total bank liabilities by country GDP. There are other factors which affect the systemic status to a bank than the absolute size of its liabilities; however they all tend to be hard to measure accurately, and the size of bank liabilities as easy to measure should be a reliable tool. Though in reality would perhaps a small and regional bank be just as systemically important than a large and global bank located in the same country, because the regional bank would have large amount of information capital by knowing the local industries, which could be lost in a bank default. By including a large number of banks from several countries in my analysis I will

strengthen liabilities-to-GDP ratio's validity as a measurement of systemic size. By using liabilities as a whole I am implying that the total liabilities would be saved in a bank rescue operation, not only the deposit insurance guaranteed amount.

There is a possibility that the relationship between systemic status and liabilities ratio is non-linear, hence not explained by liabilities-to-GDP. To allow for an exponential relationship between liabilities and GDP I include liabilities-to-GDP ratio squared in some of my regressions. Another way of handling a non-linear systemic size relationship is to include dummy variables on systemic size; in the analysis I test for dummy variables with systemic size 0.1, 0.25, 0.5 and 1. Further I include size of other banks total liabilities-to-GDP ratio, to check whether size of other banks affect market-to-book valuation of the actual bank, as well as including variable for total country bank size-to-GDP ratio.

Assets: My second explanatory variable is bank assets, presented as the natural logarithm of balance-reported total assets. Assets show bank absolute size, and should affect bank valuation among other things; bank economies of scale, benefit of diversification and growth opportunities.

Fiscal balance: The last explanatory variable is fiscal balance, defined as government income minus expenses as a share of GDP. The idea is that the current state of country public finances, as measured by fiscal balance, should effect market-to-book valuation of banks if the banks possess status as TBTF (or TBTS). If a country's public finances are in a relatively bad state, it is less likely to provide for an extensive implicit safety-net; hence in a TBTS situation banks should expect even less of its TBTF protection when a country faces bad public finances. As many European countries facing difficult economic times it is likely that fiscal balance would affect market-to-book ratio.

Fiscal balance is affected by cyclical changes in the economy. To try and correct for this, Demirgüç-Kunt and Huizinga (2012) uses old age dependency ratio and openness to trade as instruments for fiscal balance. I will describe IV regression and the variables later in this chapter. As a robustness check I also swap fiscal balance with primary fiscal balance and government spending.

3.3.1 Bank-specific control variables

Fee income is the natural logarithm of bank non-interest. A high fee income reflects that the bank gets more of its income from consultancy, corporate banking and other services, which might affect how the bank is valuated. Usually in recessions banks would see their losses on loans rise, then if the bank gets a relatively higher part of its income from non-interest operations it would not be as exposed to the recession. However there are many non-interest banking services which suffer from being in a very cyclical market, like mergers and acquisitions or initial public offerings. Research by Baele, Jonghe and Vennet (2007) suggests that bank value is positively related with higher share of non-interest income.

Leverage is defined as total bank liabilities to total assets, and shows how large share of the bank's assets are externally financed. A high leverage implies that the bank owners has to put up relatively less equity for the same amount of assets owned by the bank, creating a larger return on equity for the owners, which again should affect the banks market-to-book value positively. Leverage is also making the bank more vulnerable to volatility on its asset value and earnings, which in some cases should lead to a negative effect on market-to-book ratio. The higher leverage in a bank – the less losses the bank can absorb before the amount of liabilities surpasses the value of its assets, in other words bank getting insolvent. Hence should a bank with high risk and high leverage have negative effect on market-to-book value, which leads to the next control variable.

Bank asset risk is the annualized standard deviation of daily stock prices multiplied with the ratio of market value of common equity to the book value of bank assets. This ratio shows the deleveraged bank asset risk, isolating the underlying asset risk from leverage-related risk. A higher leveraged bank with safer assets could have lower chances of failure than a low leveraged bank with a lot of toxic assets. This difference is covered in the analysis by using an interaction term with bank asset risk and leverage to define how exposed the bank is to insolvency. A near-insolvent bank should result in lower market-to-book ratio.

Pre-tax income is total pre-tax income as a share of total assets. A bank with high pre-tax income is able to generate more income out of the same amount of assets, hence it should be priced at relatively higher market-to-book ratio.

3.3.2 Country-specific control variables

GDP per capita is total country GDP divided by country citizens, and is reported in constant 2000 USD. GDP per capita indicates how well overall economic development is in a country.

GDP growth is the growth of GDP in real terms, which is a proxy for overall economic growth in the country, which again influence potential growth in banking.

Primary balance is included as an alternative measurement of current country financials. Primary balance is government income minus expenses minus interest payments on government debt. This variable is used in robustness checks on my initial empirical results.

Government spending is total government spending per year as a share of GDP, and figures as a third way of measuring current state of public finances. This variable is used in robustness checks on my initial empirical results.

In addition to these bank- and country-specific control variables; Demirgüç-Kunt and Huizinga (2012) included deposit market share, leverage other banks, time since crisis, past crisis and past fiscal cost as control variables. Deposit market share is the ratio between bank liabilities and total bank liabilities in a country. My observations of total bank liabilities by country are too limited to include deposit market share as control variable in my analysis (reduces observations with 40%), however when included, it is estimated with very low economic significance (not reported). Due to limited database access was data on control variable leverage other banks not available. The data from control variables time since crisis, past crisis and past fiscal costs are variables identified by Laeven and Valencia (2008, 2010), were not available.

3.4 Methodology

I follow the methodology of Demirgüç-Kunt and Huizinga (2012) in the empirical analysis, performing regressions where I aim to explain how the bank- and country-specific variables discussed above affect market-to-book ratio, and on behalf of the estimated coefficients try to locate whether banks in Europe trade with a TBTF protection or with a TBTS status. Since my dataset is collected over a period of 25 years it could be subject to possible auto-correlations. It is not unlikely that some of the variables affecting market-to-book ratio contains lagged effects, hence the problem of non-independent residual within each bank across time periods, which again could cause heteroscedasticity. Another possible problem is serial correlation, correlation

between some of the banks within a time period. It is reasonable to think that valuation of banks from the same country somehow is correlated, for example due to regulatory changes or cyclical fluctuations. To cope with these auto- and serial-correlation problems I run all regressions in the analysis with adjustments for correlations within each group, having defined each bank as a group. As well as estimating robust standard errors using the Huber-White estimators, to adjusts for problems with normality and heteroscedasticity. Having done these measures I assume my estimated coefficients and standard error to be valid estimates on determinants for market-to-book ratio to be used in the further analysis.

In the last part of the analysis I perform multiple robustness checks to look for economic inconsistencies in my results. First I swap liabilities-to-GDP with the various Big dummy variables to include possibility of non-linear relationship between systemic size and market-to-book ratio. Then I test for different measures of current state of public finances by using government spending and primary fiscal balance as variables. Lastly I add time-specific dummy variables to allow for structural changes in my dataset, respectively when the EMU countries adopted Euro as common currency in 1999 and at the 2008 financial crisis.

3.4.1 Instrumental variable approach

Instrumental Variable regression is used by Demirgüç-Kunt and Huizinga (2012); using old-age dependency ratio and openness to international trade as instruments for fiscal balance. Old-age dependency ratio is the number of people above 65 years as a share of working age population, which should proxy how the economic outlook for a country is, based upon the relationship between workers who pay tax and seniors receiving pensions and health care. Openness to international trade is sum of exports and imports as a share of GDP. Research by Rodrik (1998) indicates that higher government spending in open economies reduces fiscal balance (Demirgüç-Kunt and Huizinga 2012).

When using openness and old age dependency ratio as instruments for fiscal balance on my dataset both the Sargan test and the Durbin-Wu-Hausman edogeneity test fails to confirm the validity of the instruments. Sargan test has the null hypothesis that the instruments are valid estimates for the excluded variable. Durbin-Wu-Hausman test has the null hypothesis that the IV and OLS estimators are not statistically different; hence IV regression is not needed. The null is rejected for Sargan's test with a p-value 0,359 suggesting that the instruments are too weak

and that the excluded variable is underestimated (not reported). The null is not rejected for the Durbin-Wu-Hausman test with p-value 0,000 (not reported), suggesting that IV regression is not needed. Demirgüç-Kunt and Huizinga (2012) gets the same result on Durbin-Wu-Hausman test, but they are able to reject Sargan's null. This difference can be explained by the selection of data. Where I focus only on European banks, does their dataset include data from banks globally, where US banks alone accounts for over 66% of analyzed banks in the dataset. Due to my negative results on the instrument-tests I will not use further IV regression in my analysis.

Chapter 4 – The dataset

Since the dataset used by Demirgüç-Kunt and Huizinga (2012) is not available, I had to collect all the data from various data sources available through NHH. I found it time-consuming to collect and prepare the data from different databases to a common form. This chapter explains shortly my work with the dataset, followed by descriptive and summary statistics from my dataset, illustrated with figures and comments.

4.1 About the data

I analyze a total of 141 listed European banks (see Appendix 3 for a list of banks analyzed) using a list of large European banks from Datastream. By choosing listed banks I get more reliable and comparable data, though since many of the banks are listed at several stock exchanges often in different currencies, I have spent a lot of time with the initial data management.

Data is collected from several databases, but due to limited access at NHH I could not follow Demirgüç-Kunt and Huizinga (2012) directly on the sources. I use Compustat Global and Compustat Securities Daily for all bank-specific variables. IMF World Economic Outlook, OECD Banking Statistics and World Bank Development Indicators are used for the country-specific variables. See Appendix 2 for detailed list of variables and their sources. All the data are directly downloaded to either Stata or Excel, which are the only programs used in the empirical work of this thesis.

4.2 Data problems and challenges

During the data management work I spent a lot of time solving problem related to the data not fitting together. Some of the balance sheet variables are not reported in the same currency as the bank's stock price, hence creating a problem when trying to use the data together. Some banks are listed at several stock exchanges, in different countries. Some countries have had periods with very high inflation followed by revaluation of the currency, which easily creates asymmetry and outliners in the data. The implementation of euro was introduced in the stock prices from 1999, but in the bank balance sheets from 1998. Time series of country GDP is posted in last year's currency, compared to the bank balance sheet items that follow the actual currency each year. Since my market value is calculated as yearly average based on daily observations, I am exposed to structural changes in each bank happening in the middle of the

year, which can create outliers. One example is the spin-off of a polish bank November 2007, which adjusted book value of equity by 80%. Such outliers have been removed

4.3 Descriptive statistics

Table 4.A - Summary statistics on variables used (dummies not included)

	N	Mean	Std.err.	min	max
Market-to-book	2228	1,421	0,022	0,029	20,044
Assets	2225	25,394	0,063	17,388	38,308
Fiscal balance	2119	-2,625	0,090	-30,946	18,787
Liabilities	2191	0,253	0,010	0,000	4,607
Bank asset risk	2217	2,176	1,687	0,000	3708,759
Leverage	2225	0,920	0,002	0,008	0,998
Fee income	1837	20,812	0,075	11,581	35,025
Pre-tax income	2222	0,010	0,001	-0,486	0,770
GDP per capita	2194	28254,180	379,119	1333,606	118908,600
GDP growth	2182	2,207	0,059	-14,800	11,06
Sum liabilities	1383	2,384	0,081	0,000	31,942
Other liabilities	1383	2,151	0,077	-0,764	30,129
Square liabilities	2191	0,285	0,025	0,000	21,228
Primary balance	1808	0,543	0,084	-27,863	16,121
Gov. spend.	2119	44,441	0,151	30,315	67,225

Year 2011	Bank systemic size <0,5			Bank systemic size <0,5		
	N	Mean	Std.err.	N	Mean	Std.err.
Market-to-book	102	0,983	0,053	30	0,772	0,087
Assets	102	24,569	0,183	30	26,659	0,387
Fiscal balance	102	-2,476	0,374	28	-4,251	0,953
Liabilities	102	0,086	0,010	28	1,110	0,113
Bank asset risk	102	0,002	0,000	30	0,001	0,000
Leverage	102	0,909	0,008	30	0,948	0,003
Fee income	88	19,854	0,215	25	21,719	0,454
Pre-tax income	102	0,003	0,002	30	-0,002	0,004
GDP per capita	102	37007,760	2554,372	28	47101,090	4342,091
GDP growth	102	2,319	0,296	28	1,118	0,369
Square liabilities	102	0,018	0,004	28	1,574	0,318
Primary balance	89	-0,031	0,333	24	-2,213	0,858
Gov. spend.	102	43,404	0,732	28	47,004	1,082

This table shows summary statistics of variables from my dataset used directly in the analysis in later chapters. Market-to-book is the market value of the common equity as a share of book value of common equity. Assets is natural logarithm of total assets. Fiscal balance is government revenues minus expenses as a share of GDP (denoted in percentage points). Liabilities is total liabilities as a share of GDP. Bank asset risk is the annualized standard deviation of daily bank stock returns adjusted for leverage. Leverage is the total liabilities divided by total assets. Fee income is the natural logarithm of bank non-interest income. Pre-tax income is the pre-tax income as a share of total assets. GDP per capita is GDP per capita in constant 2000 USD. GDP growth is growth of GDP in real terms (denoted in percentage points). Sum liabilities is total country bank liabilities as a share of GDP. Other liabilities is total size of other banks liabilities in a country as a share of GDP. Square liabilities is Liabilities squared. Primary balance is fiscal balance less interest expenditures, as a share of GDP. Gov. spend. Is government expenditures as a share of GDP (denoted in percentage points).

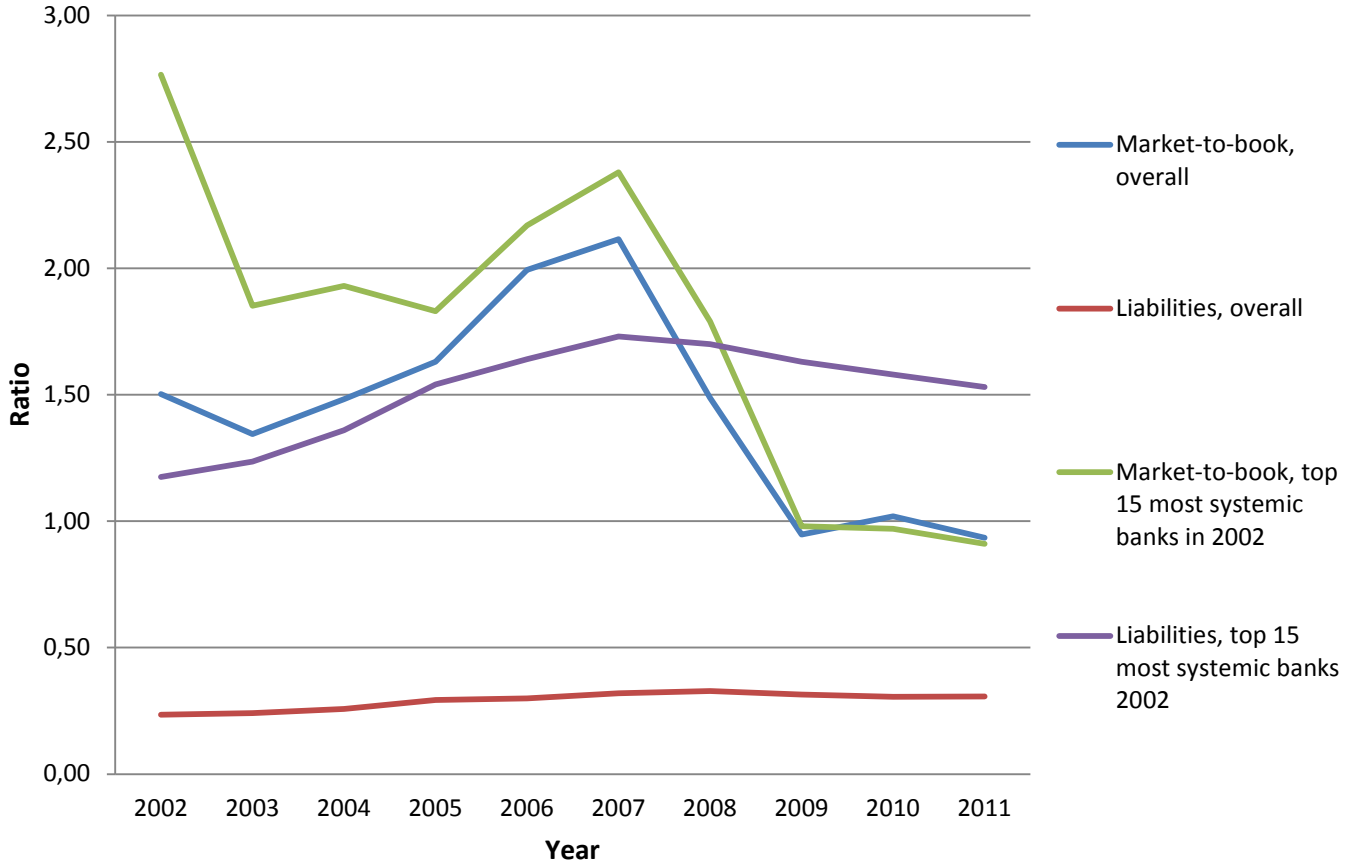
Table 4.A shows descriptive statistics of the variables used in my regressions and robustness checks, the top section is total for the whole dataset, whereas the below section is for 2011. As I only have complete data on 68 banks for 2012 I present 2011 numbers. It is interesting to see the differences between the banks with systemic size >0,5 (systemic size defined as total liabilities as a share of GDP) and less systemic banks.

4.3.1 Bank-specific variables

Market-to-book ratio has an overall mean of 1,42 compared to 0,78 in 2012 (based on calculations from my dataset based on observations from 68 banks in 2012). Damodaran (01.2013) reports a ratio of 0,74. The lower ratio indicates that banks now are less able to generate value compared to its book value. Another interesting observation about market-to-book ratio is the difference between systemic banks, where banks with systemic size above 0,5 is prices notably lower than banks with less than 0,5 in systemic size.

Liabilities has an overall average of 0,25 in my dataset, compared to Demirgüç-Kunt and Huizinga (2012) average of 0,06. The dataset in their article is highly affected by including the US banks, which accounts for over 2\3 of the analyzed banks. US has a highly dispersed banking system with only 3 banks >0,5 in systemic size (Demirgüç-Kunt and Huizinga 2012). In my study of European banks the 28 most systemic banks averaging systemic ratio of 1,1 in 2011, compared to the other 102 banks averaging at 0,086. Among the control variables pre-tax income is negative in 2011 for the most systemic banks, leverage is averaging 0,95 in 2011 among the large banks compared to 0,91 in the less systemic banks.

Fig. 4.A



This figure shows the development of market-to-book ratio and liabilities-to-GDP ratio for European banks for the years 2002–2011. All data from my dataset.

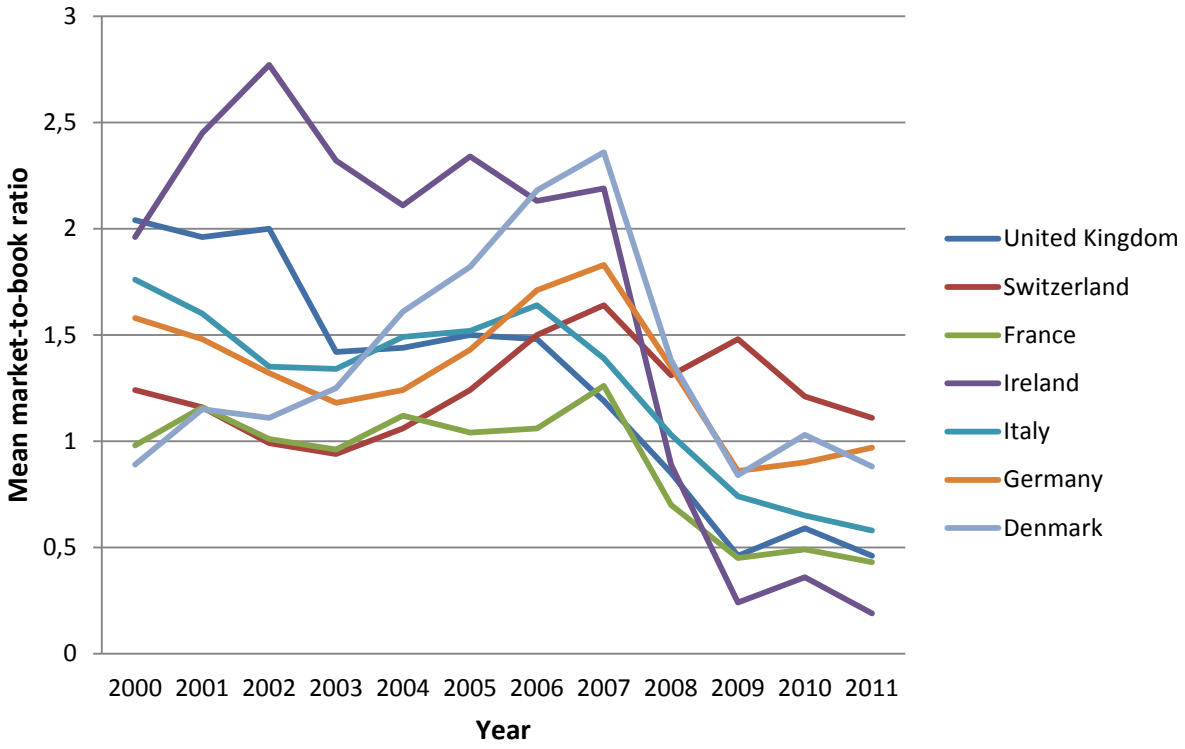
Figures 4.A and 2.C (found on page 9) illustrates the loss of market-to-book value and the systemic size has changed over the years. 4.A shows that the 15 largest banks in 2002 have lost its gain, and is now priced lower than its less systemic counterparts. Figure 2.C shows a vast decline in systemic size for some of the largest banks in Europe. Of the selected banks only HSBC increases its liabilities-to-GDP ratio from 2011 to 2012. Systemic size of the two Swizz banks UBS and Credit Suisse has declined 55% and 45% from the peak in 2005-2006. These two figures show that the 2008-2009 financial crisis had a remarkable effect on big banks in Europe.

4.3.2 Country-specific variables

Fiscal balance averaging negative 2,63%, in 2011 the financial state of the country who holds the 28 most systemic banks have almost twice as negative fiscal balance on average, as the countries containing the less systemic banks, respectively -4,25 compared to -2,47. Among the country-specific control variables government spending is notably higher in the countries which have the most systemic banks. Real term growth in GDP averaging 2,2 % for the whole dataset,

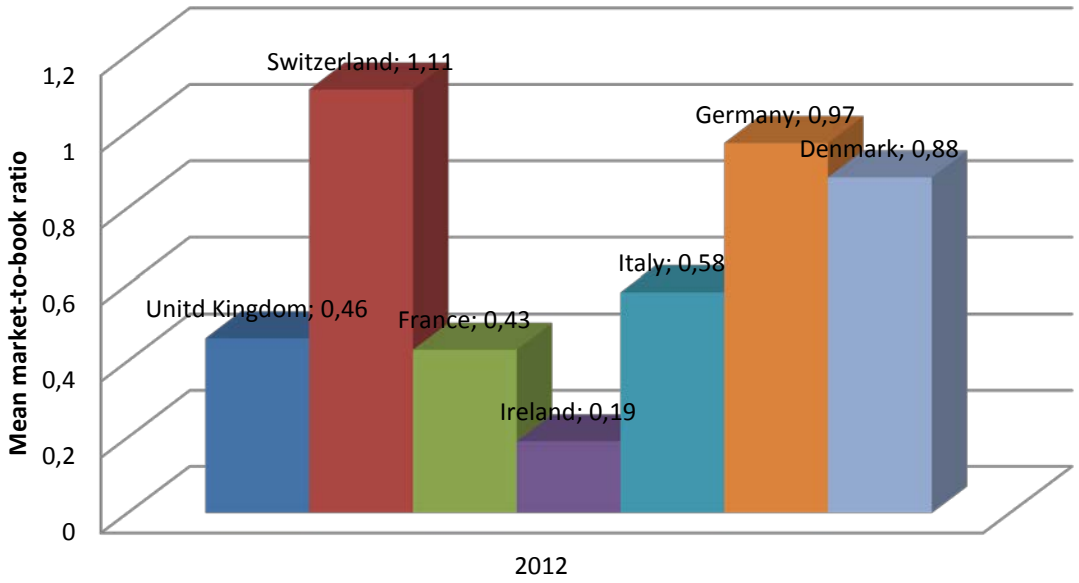
in 2012 the countries with the most systemic banks have on average half the growth compared to the rest of the countries, respectively 1,1 % and 2,3 %.

Fig 4.C Market-to-book ratio - selected countries



This figure shows the market-to-book ratio during 200-2011 for a selection of European countries with large banking industry.

Fig. 4.D Market-to-book ratio



This figure shows the difference in mean market-to-book ratio in selected European countries.

Figures 4.C and 4.D shows how the mean market-to-book ratio varies widely across nations. 4.C shows to some degree through bank valuation which country that was struck the hardest in the aftermath of the recent financial crisis. 4.D is status 2012, with banks in Switzerland, Germany and Denmark performing better than their counterparts in UK, France, Ireland and Italy. Some of the differences between the countries could also be explained by different levels of TBTF-protection or a TBTS status.

Chapter 5 – Analysis of the empirical evidence

In this chapter I will present tests of too big to fail versus too big to save in European banking following the analytical approach of Demirgüç-Kunt and Huizinga (2012), with additional reflections and perspectives. First I discuss the tests, followed by empirical evidence and robustness checks.

5.1 TBTF versus TBTS

Whether a bank is too big to fail or too big to save is impossible to measure accurately, since we are not able to observe it directly. It should however be possible to find indication on whether TBTF or TBTS through investors valuation of banks. Market-to-book ratio would be positively affected by a TBTF protection through implicit guarantees by the country's safety net effectively reduces risk of default, as in time of crisis banks close to default are often rescued as a whole. On the other hand when a bank is saved the authorities sometimes wipes out, or marginalizes the existing shareholders through nationalization or injection of fresh capital. A TBTF protection would reduce the risk of bankruptcy, since a share of its risk is covered by the authorities. Implying that TBTF protection would also affects market-to-book ratio positive through cheaper cost of capital. Cheaper cost of capital is positively awarded because it should give the bank opportunity to create relatively more return on capital, compared to non-TBTF banks investing in the same assets.

In a situation with TBTS; market-to-book ratio would be affected negatively through the same channels. If a country is not financially able to rescue the banks in time of crisis, all the factors providing a positive effect under a TBTF protection is effectively removed. Credit would get more expensive through bank creditors not being able to rely on implicit state guarantees.

An important factor not discussed in Demirgüç-Kunt and Huizinga (2012) is the ever increasing role of the central banks in the stability of financial markets. In the recent years the central banks have increased their activities both in traditional monetary policies, and in more of special interactions such as open ended buying of assets from banks (TARP) and low cost lending with little or no requirements to collateral posted (LTRO). The highly active central banks have most likely had a significant effect on bank market valuation, for example through its LTRO operations giving European banks very cheap long term loans, which effectively

reduced liquidity risk in the European bank industry. None of my variables includes this effect in a good way, and hence central bank activities create noise in my results.

5.1.1 Regression table 5.A

Market-to-book	(1)	(2)	(3)	(4)
	Coef. (std.err.)	Coef. (std.err.)	Coef. (std.err.)	Coef. (std.err.)
Assets	-0.010	-0.011	-0.154	-0.107
	(0.016)	(0.017)	(0.051)	(0.051)
Fiscal balance	0.024	0.024	0.006	0.015
	(0.014)	(0.014)	(0.011)	(0.010)
Liabilities	0.217	0.214	0.094	0.205
	(0.146)	(0.147)	(0.115)	(0.112)
Bank Asset Risk * Leverage		-0.267	-0.280	-0.255
		(0.074)	(0.066)	(0.073)
Bank Asset Risk		0.246	0.258	0.235
		(0.068)	(0.061)	(0.067)
Leverage		0.178	2.600	2.448
		(0.342)	(0.852)	(0.879)
Fee Income			0.129	0.073
			(0.051)	(0.049)
Pre-tax income			24.685	17.067
			(7.597)	(5.683)
GDP per capita				-0.000
				(0.000)
GDP growth				0.078
				(0.010)
Constant	1.693	1.549	-0.069	0.251
	(0.406)	(0.446)	(0.817)	(0.839)
R-squared	0.021	0.029	0.137	0.250
N. of observations	2116	2108	1728	1725

The table shows OLS point estimators of the endogenous variable market-to-book ratio, which is the market value of the common equity as a share of book value of common equity. Assets is natural logarithm of total assets. Fiscal balance is government revenues minus expenses as a share of GDP. Liabilities is total liabilities as a share of GDP. Bank asset risk is the annualized standard deviation of daily bank stock returns adjusted for leverage. Leverage is the total liabilities divided by total assets. Fee income is the natural logarithm of bank non-interest income. Pre-tax income is the pre-tax income as a share of total assets. GDP per capita is in constant 2000 USD. GDP growth is growth of GDP in real terms. All regressions runs with robust standard error estimation, adjusted for correlation within each bank from year to year. *, ** and *** is statistical significance at respectively 10%, 5% and 1%.

Regression 5.A - (1) shows the results of the initial regression model, fiscal balance variable statistically significant at <10%, variables assets and liabilities insignificant. However this first regression only explains about 2,1% of the actual fluctuations (R-squared = 0,021). I add the different bank-level control variables in (2) and (3), whereas in the last regression (4) I also add

country-specific control-variables. In regression (4) assets and liabilities are estimated with statistically significant effect at <5% and <10% level, regression explaining 22,4 % of the fluctuations in market-to-book ratio.

After adding the control variables in (4), **assets** is negatively related to market-to-book ratio with a point estimator of -0,11, statistically significant at <5%. This indicating that bank size does matter for investors in a negative way, saying that if an already large- or medium sized bank were to increase its assets, it would have a ceteris paribus negative effect on the market valuation. This is consistent with a TBTS situation, since under a TBTF protection the bank would claim a relatively larger share of the implicit safety-net by increasing in absolute size. However there are other factors in bank asset size affecting price-to-book ratio; larger banks tend to be more diversified (Demsetz and Strahan 1997), hence being able to take on more risky positions, for example by holding more illiquid assets. Larger asset size would then point to possible higher future earnings due to increased diversification. Another possibility is economies- or diseconomies of scale due to increasing bank size. Diseconomies of scale could occur as a consequence of the bank being harder to manage effectively, and/or through the complexity of the bank making it harder for the bank to monitor and control net risk exposure.

In Regression 5.A – (4) **fiscal balance** is positively related to market-to-book ratio, with a point estimator of 0,015, statistical significance above 10% (p-value = 0.13). This indicates that the state of the public finances, as measured through fiscal balance, could affect bank valuation though unsure due to too low significance. In a situation with TBTF protection, positive relationship between fiscal balance and market-to-book ratio indicating that the country is able to guarantee for a relatively higher (or lower) amount of the banking industry. The same logic attends when in a TBTS situation; the worse state public finances gets in, the less is the doubt that the country's banks do possess status as TBTS. Another plausible relationship, not discussed in Demirgüç-Kunt and Huizinga (2012), is fiscal balance affecting market-to-book value through future expected bank losses following that a fiscally strapped government would have to cut back on spending in recessions, possibly prolonging the recession. Investors would then price banks in fiscally strapped countries relatively less than in fiscally sound countries, due to relatively higher expected bank losses in recessions.

In table 5.A – (4) Systemic size as measured in **liabilities** is positively related to market-to-book ratio, with a point estimator of 0,205, statistically significant at <10%. Meaning that banks who increases their systemic size, would also increase their market valuation through increased market-to-book ratio. This is consistent with gaining TBTF protection when growing in systemic size, since a relatively more systemic bank would be able to claim a relatively higher amount of the implicit state guarantee. The bigger the bank is relative to GDP, the larger would the negative externalities of a bankruptcy be, hence increased implicit protection from the authorities. Another plausible explanation of bank systemic size increasing bank market valuation can be through less competition; it is reasonably that the largest banks do have greater impact on the market, and are more able to set the prices. Large and systemic banks would probably have greater impact on the politics considering regulation on banks, and controlling government agencies would be cautious about making regulations with harsh impacts on the systemic bank in fear of negative externalities. This is clearly hard to measure in any way, but there is economic logic on the thought that more political- and market power gives the bank a positive edge compared to other non-systemic, hence increased market valuation.

Continuing with systemic size I would like to point out one point of view not discussed by Demirgüç-Kunt and Huizinga (2012); that the structure of total bank liabilities would have impact on bank valuation. Bank total liabilities usually exist of several different types of liabilities, ranging from short term interbank borrowing, fixed rate deposits, various derivatives liabilities and many more. Research on bank valuation by C. W. Calomiris and D. Nissim (2007) suggests that the composition of the underlying liabilities in total bank liabilities do have an effect in how profitable the bank is.

The **control variables** are all statistically significant at <1% level. Bank asset risk and leverage is estimated with positive determinants, although the interaction between them is estimated with negative determinant at -0,255 and <1% significance. This reflects that a bank with both high asset risk and high leverage is priced relatively lower than other banks, which is consistent with a TBTS situation. Bank asset risk together with leverage gives an indication on the probability of bankruptcy. The level of leverage states how much loss a bank could cope with before being insolvent, and the bank asset risk states how likely a bank is to receive losses on its assets based on historical volatility. High leverage is not necessary a signal of a very risky bank if its assets are

very safe, and conversely would a high bank asset risk not necessary be a signal for a risky bank if the leverage is low.

Among the other controls fee income is estimated with a point estimator of 0,083, pre-tax income with a point estimator of 17,137, GDP per capita with a point estimator -0,000, GDP growth with a point estimator of 0.083. A table showing correlation between variables is presented in Appendix 3. Fee income has high correlation with explanatory variable Assets, however this makes sense since on average large banks would generate more fee income than small banks. Due to large sample size I am still able to use fee income as controlling variable.

5.1.2 Regressions table 5.B

Market-to-book	(1)	(2)	(3)	(4)
	Coef.	Coef.	Coef.	Coef.
	(std.err.)	(std.err.)	(std.err.)	(std.err.)
Assets	-0.121**	-0.139***	-0.107**	-0.147***
	(0.049)	(0.049)	(0.052)	(0.051)
Fiscal balance	0.001	-0.002	0.015	-0.002
	(0.012)	(0.012)	(0.010)	(0.012)
Bank asset risk * leverage	-0.449***	-0.455***	-0.255***	-0.456***
	(0.023)	(0.022)	(0.073)	(0.022)
Bank asset risk	0.413***	0.419***	0.235***	0.420***
	(0.021)	(0.020)	(0.067)	(0.020)
Leverage	2.859**	2.670**	2.453***	2.608**
	(1.152)	(1.033)	(0.884)	(1.015)
Fee income	0.100**	0.092*	0.073	0.097**
	(0.049)	(0.047)	(0.050)	(0.048)
Pre-tax income	14.350**	14.791***	17.071***	14.681***
	(5.569)	(5.557)	(5.688)	(5.520)
GDP per capita	-0.000**	-0.000**	-0.000***	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
GDP growth	0.088***	0.091***	0.078***	0.092***
	(0.013)	(0.013)	(0.010)	(0.013)
Sum liabilities	-0.000			
	(0.029)			
Liabilities		0.359**	0.195	0.520*
		(0.157)	(0.231)	(0.277)
Other liabilities		-0.035		-0.037
		(0.028)		(0.028)
Square liabilities			0.005	-0.069
			(0.122)	(0.117)
Constant	-0.282	0.480	0.245	0.618
	(1.075)	(0.967)	(0.851)	(0.955)
R-squared	0.198	0.217	0.224	0.218
N. of observations	1092	1092	1726	1092

The table shows OLS point estimators of the endogenous variable market-to-book ratio, which is the market value of the common equity as a share of book value of common equity. Assets is natural logarithm of total assets. Fiscal balance is government revenues minus expenses as a share of GDP. Bank asset risk is the annualized standard deviation of daily bank stock returns adjusted for leverage. Leverage is the total liabilities divided by total assets. Fee income is the natural logarithm of bank non-interest income. Pre-tax income is the pre-tax income as a share of total assets. GDP per capita is in constant 2000 USD. Real GDP-growth is growth of GDP in real terms. Sum liabilities is total country bank liabilities as a share of GDP. Liabilities is total liabilities as a share of GDP. Other liabilities is total size of other banks liabilities in a country as a share of GDP. Square liabilities is Liabilities squared. All regressions runs with robust standard error estimation, adjusted for correlation within each bank from year to year. *, ** and *** is statistical significance at respectively 10%, 5% and 1%.

In Regression 5.B I continue from 5.A-(4), adding new definitions on systemic size. First I swap liabilities with sum liabilities, which are the total country liabilities as a share of GDP. In the same analogy as liabilities should sum liabilities affect market-to-book ratio in a TBTF and TBTS situation. However point estimate of the coefficient is insignificant. In (2) I split sum liabilities in liabilities and other liabilities, separating between the liabilities of the actual bank, and the liabilities of other banks in the country. Point estimates of the coefficients is estimated at 0,359 and -0,035 for liabilities and other liabilities, liabilities statistical significant at <1% other liabilities statistically insignificant. The coefficient estimated on other liabilities indicates that the systemic size of other banks would affect market valuation of the analyzed bank in a negative way, possibly through a TBTS status. Though since liabilities is estimated with positive coefficient, other liabilities is more likely negative as a reason of increased competition with other big banks. Whether a bank is alone in being very large in a country or not, would give indications on if there is high competition. The ratio of other liabilities would also give indication on how many other systemic banks in the country, and for example how the bank is alone or not in providing for the payment system. In a country with many large banks, each would have less importance in the payment system, and other vital parts of the financial markets.

In regression 5.B-(3) I include square liabilities to allow for a non-linear relationship between bank systemic size and market-to-book ratio. Its coefficient is estimated at 0,009, statistically insignificant. Liabilities are estimated with reduced point estimator, statistically insignificant. This could give indications on a non-linear relationship between systemic size and market-to-book ratio, not covered for in square liabilities. This is consistent with the main critics expressed by Barth and Schnabel (2011), about using liabilities-to-GDP as measurement of systemic size, due to non-linear relationship. Regression 5.B-(3) has the highest explanatory power of 22,4 % on the fluctuations in market-to-book ratio.

As of the other explaining variables; assets is mostly unchanged through Regressions table 5.B. Fiscal balance is less stable with statistical insignificant and with very small point estimator; casting doubt on the linear relationship between market-to-book ratio and state of government public finances measured through fiscal balance.

5.1.3 Regressions table 5.C

Market-to-book	(1)	(2)	(3)	(4)
	Coef. (std.err.)	Coef. (std.err.)	Coef. (std.err.)	Coef. (std.err.)
Assets	-0.107	-0.103	-0.105	-0.101
	(0.051)	(0.052)	(0.051)	(0.052)
Fiscal balance	0.015	0.004	0.015	0.004
	(0.010)	(0.010)	(0.010)	(0.010)
Bank asset risk * Leverage	-0.255	-0.256	-0.247	-0.248
	(0.073)	(0.073)	(0.020)	(0.018)
Bank asset risk	0.235	0.236	0.222	0.223
	(0.067)	(0.067)	(0.019)	(0.017)
Leverage	2.448	2.516	2.443	2.510
	(0.879)	(0.873)	(0.881)	(0.874)
Fee income	0.073	0.066	0.070	0.063
	(0.049)	(0.049)	(0.049)	(0.050)
Pre-tax income	17.067	17.392	17.087	17.412
	(5.683)	(5.708)	(5.694)	(5.719)
GDP per capita	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
GDP growth	0.078	0.075	0.077	0.074
	(0.010)	(0.010)	(0.010)	(0.010)
Liabilities	0.205	0.306	0.207	0.308
	(0.112)	(0.084)	(0.112)	(0.084)
Liabilities * Fiscal balance		0.051		0.051
		(0.010)		(0.010)
Liabilities * Bank asset risk * Leverage			0.313	0.314
			(0.042)	(0.041)
Constant	0.251	0.227	0.273	0.249
	(0.839)	(0.831)	(0.840)	(0.832)
R-squared	0.250	0.259	0.254	0.263
N. of observations	1725	1725	1725	1725

The table shows OLS point estimators of the endogenous variable market-to-book ratio, which is the market value of the common equity as a share of book value of common equity. Assets is natural logarithm of total assets. Fiscal balance is government revenues minus expenses as a share of GDP. Bank asset risk is the annualized standard deviation of daily bank stock returns adjusted for leverage. Leverage is the total liabilities divided by total assets. Fee income is the natural logarithm of bank non-interest income. Pre-tax income is the pre-tax income as a share of total assets. GDP per capita is in constant 2000 USD. GDP growth is growth of GDP in real terms. Liabilities is total liabilities as a share of GDP. All regressions runs with robust standard error estimation, adjusted for correlation within each bank from year to year. *, ** and *** is statistical significance at respectively 10%, 5% and 1%.

Regression 5.C-(1) is the same as 5.A-(4). In 5.C-(2) I add an interaction between liabilities and fiscal balance, which is estimated with coefficient 0,051, statistically significant at <1%. This relationship indicates that systemic banks do depend on the country's financial state, as measured by fiscal balance. Whereas the positive point estimator revealing that systemic banks

will be priced higher when public finances are doing good, compared to systemic banks being priced lower when public finances are less good (<0%). Another observation in the regression is that fiscal balance insignificant when allowing the interaction between liabilities and fiscal balance. This indicates that the explanatory power of fiscal balance to market-to-book ratio is through the most systemic banks, which is consistent with a TBTS situation, where the market value of a bank depends on the fiscal state of the country. However the estimated coefficient is very low, casting some doubt on its economic significance.

The determinants on liabilities*fiscal balance' effect on market-to-book ratio could also be explained by banks owning large amounts of country government bonds, which value is likely to follow the state of country public finances. The effects can also be causal; it is not unlikely that large banks are more exposed to cyclical fluctuations, hence its market valuation reacts in the same way as government fiscal balance.

In regression 5.C-(3) I replace the interaction between liabilities and fiscal balance with another interaction between liabilities, bank asset risk and leverage. This casts light on how the bank risk (as measured by bank asset risk*leverage) affect market-to-book ratio appear to depend on the bank's systemic size, as measured by liabilities. Coefficient is estimated at 0,313, statistically significant at <1% level. This indicates that the market valuation of systemic size has a positive relationship with bank asset risk, saying that a relatively more systematic bank is rewarded for taking higher risk. This finding is the opposite as the effect from the interaction term between bank asset risk and leverage in my original regression 5.A-(4), indicating that larger banks could expect more of a financial safety-net provided by the authorities, since they are rewarded for taking relatively larger risk, or in other words strong evidence of TBTF protection on systemic banks.

A possible alternative explanation is that the largest and most systemic banks are more diversified than smaller and less systemic banks; hence they are rewarded for taking more risk because they are able to hold more risk. In regression 5.C-(4) I include both the interactions, receiving similar results.

5.2 Robustness checks

In the first robustness checks, presented in Regression table 5.D, I swap liabilities variable with the various Big' dummy variables in regressions equal to Regression table 5.C. By having a categorical definition of systemic size through dummy-variables I should be able to cover non-linear effects on market-to-book ratio defined by bank systemic size.

5.2.1 Regression table 5.D

Market-to-book

	(1) Coef. (Std.err.)	(2) Coef. (Std.err.)	(3) Coef. (Std.err.)	(4) Coef. (Std.err.)	(5) Coef. (Std.err.)	(6) Coef. (Std.err.)	(7) Coef. (Std.err.)	(8) Coef. (Std.err.)
Assets	-0.115**	-0.116**	-0.117**	-0.117**	-0.107**	-0.108**	-0.102**	-0.103**
	(0.053)	(0.053)	(0.053)	(0.053)	(0.051)	(0.052)	(0.051)	(0.051)
Fiscal balance	0.015	0.007	0.014	0.007	0.015	0.006	0.014	0.005
	(0.010)	(0.013)	(0.010)	(0.013)	(0.010)	(0.011)	(0.010)	(0.011)
Bank asset risk * Leverage	-0.257***	-0.258***	-0.258***	-0.259***	-0.256***	-0.258***	-0.261***	-0.262***
	(0.074)	(0.074)	(0.074)	(0.074)	(0.072)	(0.073)	(0.070)	(0.071)
Bank asset risk	0.236***	0.238***	0.237***	0.239***	0.236***	0.238***	0.240***	0.241***
	(0.068)	(0.068)	(0.068)	(0.068)	(0.066)	(0.067)	(0.065)	(0.065)
Leverage	2.281***	2.329***	2.255***	2.302***	2.442***	2.500***	2.405***	2.460***
	(0.834)	(0.827)	(0.822)	(0.815)	(0.876)	(0.871)	(0.870)	(0.866)
Fee income	0.078	0.076	0.079	0.077	0.076	0.072	0.078	0.074
	(0.051)	(0.051)	(0.051)	(0.051)	(0.050)	(0.050)	(0.049)	(0.049)
Pre-tax income	17.053***	17.229***	16.946***	17.118***	16.976***	17.264***	15.973***	16.247***
	(5.702)	(5.718)	(5.670)	(5.685)	(5.665)	(5.698)	(5.346)	(5.379)
GDP per capita	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP growth	0.080***	0.079***	0.080***	0.079***	0.079***	0.077***	0.077***	0.075***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.010)	(0.010)	(0.010)
Big01	0.205**	0.262**	0.197**	0.252**				
	(0.093)	(0.103)	(0.093)	(0.102)				
Big01 * Fiscal balance		0.018		0.018				
		(0.015)		(0.015)				
Big01 * Bank asset risk * Leverage			1.373**	1.357**				
			(0.555)	(0.526)				
Big025					0.167*	0.272***	-0.116	-0.017
					(0.092)	(0.099)	(0.095)	(0.106)
Big025 * Fiscal balance						0.034**		0.032**
						(0.014)		(0.013)
Big025 * Bank asset risk * Leverage							145.426***	144.108***
							(25.871)	(25.725)
Constant	0.443	0.437	0.472	0.465	0.197	0.204	0.046	0.054
	(0.799)	(0.794)	(0.788)	(0.782)	(0.837)	(0.831)	(0.835)	(0.830)
R-squared	0.251	0.253	0.255	0.256	0.246	0.251	0.285	0.289
N. of observations	1725	1725	1725	1725	1725	1725	1725	1725

Regression table 5.D - continued

	(9) Coef. (Std.err.)	(10) Coef. (Std.err.)	(11) Coef. (Std.err.)	(12) Coef. (Std.err.)	(13) Coef. (Std.err.)	(14) Coef. (Std.err.)	(15) Coef. (Std.err.)	(16) Coef. (Std.err.)
Assets	-0.106**	-0.107**	-0.102**	-0.103**	-0.102**	-0.099*	-0.104**	-0.101**
	(0.051)	(0.052)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)
Fiscal balance	0.015	0.007	0.014	0.007	0.015	0.012	0.013	0.011
	(0.010)	(0.010)	(0.010)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)
Bank asset risk * Leverage	-0.257***	-0.257***	-0.260***	-0.261***	-0.256***	-0.256***	-0.258***	-0.258***
	(0.071)	(0.072)	(0.070)	(0.070)	(0.072)	(0.072)	(0.071)	(0.071)
Bank asset risk	0.237***	0.237***	0.240***	0.240***	0.236***	0.236***	0.238***	0.238***
	(0.066)	(0.066)	(0.064)	(0.065)	(0.066)	(0.066)	(0.065)	(0.065)
Leverage	2.527***	2.565***	2.439***	2.476***	2.593***	2.574***	2.586***	2.570***
	(0.896)	(0.888)	(0.874)	(0.867)	(0.918)	(0.907)	(0.913)	(0.905)
Fee income	0.077	0.074	0.079	0.076	0.072	0.068	0.077	0.073
	(0.050)	(0.050)	(0.049)	(0.049)	(0.050)	(0.049)	(0.049)	(0.049)
Pre-tax income	16.915***	17.038***	16.280***	16.406***	17.009***	17.030***	16.970***	16.992***
	(5.637)	(5.627)	(5.427)	(5.421)	(5.684)	(5.659)	(5.664)	(5.645)
GDP per capita	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP growth	0.078***	0.077***	0.077***	0.075***	0.077***	0.075***	0.078***	0.076***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Big05	0.179*	0.298**	-0.074	0.041				
	(0.108)	(0.116)	(0.105)	(0.112)				
Big5 * Fiscal balance		0.046***		0.043***				
		(0.015)		(0.014)				
Big5 * Bank asset risk * Leverage			128.706***	125.975***				
			(26.698)	(26.959)				
Big1					0.248	0.416***	-0.077	0.101
					(0.164)	(0.154)	(0.175)	(0.154)
Big1 * Fiscal balance						0.087***		0.074***
						(0.024)		(0.020)
Big1 * Bank asset risk * Leverage							221.022***	197.857***
							(40.446)	(39.509)
Constant	0.099	0.138	0.001	0.039	0.031	0.056	-0.027	0.000
	(0.854)	(0.844)	(0.837)	(0.828)	(0.864)	(0.855)	(0.860)	(0.852)
R-squared	0.245	0.251	0.268	0.273	0.244	0.251	0.253	0.258
N. of observations	1725	1725	1725	1725	1725	1725	1725	1725

The table shows OLS point estimators of the endogenous variable market-to-book ratio, which is the market value of the common equity as a share of book value of common equity. Assets is natural logarithm of total assets. Fiscal balance is government revenues minus expenses as a share of GDP. Bank asset risk is the annualized standard deviation of daily bank stock returns adjusted for leverage. Leverage is the total liabilities divided by total assets. Fee income is the natural logarithm of bank non-interest income. Pre-tax income is the pre-tax income as a share of total assets. GDP per capita is in constant 2000 USD. GDP growth is growth of GDP in real terms. Big01-025-05- 1 is dummy variables on total liabilities as a share of GDP, respectively share 0,1-0,25-0,5 and 1. All regressions runs with robust standard error estimation, adjusted for correlation within each bank from year to year. *, ** and *** is statistical significance at respectively 10%, 5% and 1%.

The different Big dummy variables is estimated with positive coefficients 0,205 0,167 0,179 and 0,248, respectively for Big01 Big025 Big05 and Big1 in regressions (1), (5), (9) and (13). Estimated coefficients of Big01 is statistical significant at <5%, Big025 and Big05 at <10%, and

Big1 insignificant. This reflect that banks with systemic size greater than 0,1 do have a positive effect in market valuation, compared to smaller and less systemic banks, consistent with a TBTF situation. However there seems not to be an increasingly TBTF status with systemic size, as the significance is falling to 10% and eventually insignificance for Big1 dummy. Another evidence of TBTF is also found in the interaction term between the various Big variables and bank risk (as measured by the interaction term bank asset risk*leverage). All estimated coefficient is positive, which indicates that banks with systemic size greater than 0,1 benefits through higher market valuation, as measured by market-to-book ratio, by increasing its risk.

The other interaction, between Big variables and fiscal balance, is increasingly positive with size, Big1 having the largest coefficient of 0,087, statistical significant at <1%. This is similar to the findings in Regression table 5.C; bank pricing is to some instinct explained by the current state of public finances. Possibly explained by some degree of TBTS in the largest banks, or as result of other underlying factors not covered for in the regression, such as macroeconomic fluctuations affecting both country- and bank finances.

The overall findings in Regression table 5.D are in line with the findings from Regression table 5.C. From both tables it seems like systemic size greater than 0,1 is rewarded by investors through higher market-to-book ratio. Further I would like to present robustness check on the results regarding state of public finances affecting market-to-book ratio through fiscal balance, as showed in Regression table 5.B. In Regression table 5.E I swap the variable fiscal balance with primary balance and government spending as a share of GDP, as measured by my variables primary balance and government spending.

5.2.2 Regression table 5.E

Market-to-book

	(1) Coef. Std.err.	(2) Coef. Std.err.	(3) Coef. Std.err.	(4) Coef. Std.err.	(5) Coef. Std.err.	(6) Coef. Std.err.	(7) Coef. Std.err.	(8) Coef. Std.err.
Assets	-0.129***	-0.147***	-0.111**	-0.161***	-0.122**	-0.143***	-0.111**	-0.145***
	(0.049)	(0.048)	(0.052)	(0.051)	(0.049)	(0.050)	(0.053)	(0.051)
Gov. spend.	-0.016*	-0.018**	-0.008	-0.019**				
	(0.009)	(0.008)	(0.006)	(0.008)				
Primary balance					-0.011	-0.009	0.015	-0.009
					(0.012)	(0.012)	(0.010)	(0.012)
Bank asset risk * leverage	-0.447***	-0.453***	-0.256***	-0.454***	-0.433***	-0.440***	-0.258***	-0.440***
	(0.023)	(0.022)	(0.073)	(0.022)	(0.022)	(0.021)	(0.066)	(0.021)
Bank asset risk	0.412***	0.418***	0.236***	0.418***	0.399***	0.405***	0.237***	0.405***
	(0.022)	(0.020)	(0.067)	(0.020)	(0.020)	(0.019)	(0.061)	(0.019)
Leverage	3.050**	2.857**	2.598***	2.771**	2.612**	2.434***	2.425***	2.422***
	(1.279)	(1.151)	(0.949)	(1.123)	(1.062)	(0.920)	(0.885)	(0.921)
Fee income	0.109**	0.101**	0.078	0.110**	0.114**	0.104**	0.086*	0.105**
	(0.048)	(0.046)	(0.049)	(0.047)	(0.051)	(0.049)	(0.052)	(0.050)
Pre-tax income	13.841**	14.200**	17.337***	13.955**	15.513**	15.590**	16.272***	15.556**
	(5.492)	(5.465)	(5.751)	(5.399)	(6.860)	(6.765)	(6.177)	(6.761)
GDP per capita	-0.000**	-0.000**	-0.000***	-0.000**	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP growth	0.076***	0.076***	0.080***	0.076***	0.100***	0.100***	0.079***	0.100***
	(0.011)	(0.010)	(0.009)	(0.010)	(0.014)	(0.014)	(0.011)	(0.014)
Sum liabilities	-0.026				0.002			
	(0.034)				(0.028)			
Liabilities		0.346**	0.199	0.606**		0.330**	0.032	0.365
		(0.155)	(0.239)	(0.301)		(0.160)	(0.207)	(0.252)
Other liabilities		-0.063*		-0.069*		-0.029		-0.030
		(0.037)		(0.037)		(0.029)		(0.029)
Square liabilities			-0.005	-0.113			0.066	-0.015
			(0.126)	(0.123)			(0.107)	(0.105)
Constant	0.316	1.184	0.381	1.476	-0.232	0.661	0.092	0.695
	(1.199)	(1.108)	(0.904)	(1.110)	(1.022)	(0.869)	(0.827)	(0.862)
R-squared	0.238	0.263	0.250	0.266	0.265	0.285	0.255	0.285
N. of observations	1091	1091	1725	1091	965	965	1466	965

The table shows OLS point estimators of the endogenous variable market-to-book ratio, which is the market value of the common equity as a share of book value of common equity. Assets is natural logarithm of total assets. Primarybalance is government revenues minus expenses plus interests paid, as a share of GDP. Gov. spend. is government total expenses as a share of GDP. Bank asset risk is the annualized standard deviation of daily bank stock returns adjusted for leverage. Leverage is the total liabilities divided by total assets. Fee income is the natural logarithm of bank non-interest income. Pre-tax income is the pre-tax income as a share of total assets. GDP per capita is in constant 2000 USD. GDP growth is growth of GDP in real terms. Sum liabilities is total country bank liabilities as a share of GDP. Liabilities is total liabilities as a share of GDP. Other liabilities is total size of other banks liabilities in a country as a share of GDP. Square liabilities is Liabilities squared. All regressions runs with robust standard error estimation, adjusted for correlation within each bank from year to year. *, ** and *** is statistical significance at respectively 10%, 5% and 1%.

Variable government spending is estimated with negative coefficients in regressions (1) to (4), indicating that government spending do effect market-to-book ratio in a negative way. Perhaps through government have less capability of saving troubling banks if they already spending much compared to GDP. Another explanation is that banks investors are aware of possible increased future taxation of banks as a consequence of today's high spending (Demirgüç-Kunt

and Huizinga 2012). The estimated coefficients are however very low, from -0,019 to -0,008, casting doubt on its actual economic significance in determining market-to-book ratio.

Primary balance is estimated with insignificant coefficients for all regressions but (7), where it is positive 0,015 and statistically significant at <1%. This is the same result as with fiscal balance in regression 5.B-(3), casting doubt on the linear relationship between bank systemic size and market-to-book ratio. Also indicating that current state of public finances only matters for some of the bank; respectively more systemic banks, as the findings in Regressions table 5.C suggested.

Lastly I will present a regression table not included in Demirgüç-Kunt and Huizinga (2012), where I include dummy variables related to years of possible structural changes in my data; respectively 1999 when introducing the common currency Euro and 2008 – which marked the start of the recent financial crisis.

5.2.3 Regressions table 5.F

Market-to-book	(1)	(2)	(3)
	Coef.	Coef.	Coef.
	(std.err.)	(std.err.)	(std.err.)
Assets	-0.109**	-0.086	-0.092*
	(0.051)	(0.052)	(0.054)
Fiscal balance	0.014	0.009	0.012
	(0.010)	(0.010)	(0.010)
Bank asset risk * Leverage	-0.255***	-0.256***	-0.256***
	(0.075)	(0.075)	(0.073)
Bank asset risk	0.235***	0.235***	0.236***
	(0.069)	(0.069)	(0.067)
Leverage	2.531***	2.223***	2.213***
	(0.942)	(0.840)	(0.831)
Fee income	0.081*	0.061	0.060
	(0.049)	(0.050)	(0.052)
Pre-tax income	16.861***	16.744***	17.112***
	(5.787)	(5.702)	(5.665)
GDP per capita	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)
GDP growth	0.079***	0.071***	0.073***
	(0.011)	(0.010)	(0.011)
Liabilities	0.174	0.089	0.349**
	(0.117)	(0.089)	(0.140)
Year<1999	-0.153**		
	(0.076)		
Year<1999 * Liabilities	0.097		
	(0.146)		
1999<year<2008		0.155***	
		(0.053)	
1999<year<2008 * Liabilities		0.237**	
		(0.102)	
Year>2008			-0.046
			(0.073)
Year>2008 * Liabilities			-0.285***
			(0.104)
R-squared	0.254	0.264	0.257
N. of observations	1725	1725	1725

The table shows OLS point estimators of the endogenous variable market-to-book ratio, which is the market value of the common equity as a share of book value of common equity. Assets is natural logarithm of total assets. Fiscal balance is government revenues minus expenses as a share of GDP. Bank asset risk is the annualized standard deviation of daily bank stock returns adjusted for leverage. Leverage is the total liabilities divided by total assets. Fee income is the natural logarithm of bank non-interest income. Pre-tax income is the pre-tax income as a share of total assets. GDP per capita is in constant 2000 USD. GDP growth is growth of GDP in real terms. Liabilities is total liabilities as a share of GDP. The year variables is dummy variables indicating which years being analyzed, e.g. Year<1999 means dummy = 1 for all observations prior to 1999. All regressions runs with robust standard error

estimation, adjusted for correlation within each bank from year to year. *, ** and *** is statistical significance at respectively 10%, 5% and 1%.

European banks seems overall to be price higher in the years 1999 – 2008 compared to the years 1987 – 1999, as the dummy variables are estimated 0.155 and -0.153, statistically significant at <1% and <5%. The years from 2008 – 2012 is less clear, as its point estimator is estimated insignificant. These findings could be due to cyclical differences, though the overall picture gives relevant information. The interaction term between banks in 2008-2012 with liabilities is estimated -0,285, compared to overall liabilities estimated positive 0,349, both statistically significant at <1% and <5%. This suggests that the most systemic banks are priced notably lower than the less systemic banks in the years 2008 – 2012, and compared to the entire dataset. This is consistent with a structural change regarding TBTF in 2008 towards less protection through the implicit safety net for the most systemic banks. There is no evidence found for a structural change in 1999 when Euro was adopted as common currency in the EMU countries.

Chapter 6 – Summary and conclusion

This thesis presents evidence that suggests European banks mostly are covered by the too-big-to-fail protection, however with evidence indicating that the largest and most systemic banks might have grown too big to save, especially in the years after 2008. To summarize my analysis I would start with underlining absolute bank asset size's negative role in determining market-to-book value of European banks. Throughout my analysis negative estimated coefficients represents a robust negative relationship, consistent with some banks being too big for the authorities to save, though also consistent with broad diseconomies of scale in banking. It seems from these results that big banks would benefit through higher market valuation by reducing size.

The other size-related explanatory variable Liabilities gives a less clear picture of TBTS, where the only the only evidence found for TBTS is for the most systemic banks in the years after 2008, represented by banks with Liabilities-to-GDP surpassing 1. Other evidence points on banks with systemic size greater than 0,1 to be more valuable than its less systemic peers; consistent with a TBTF protection on European banks with greater systemic size than 0,1. Strong evidence of TBTF is found through the interaction term of bank risk and liabilities variable, suggesting that systemic banks gain market value by increasing risk.

The last explanatory variable Fiscal balance is not determined to have a significant effect on market-to-book ratio, casting doubt on current state of public finances affecting bank valuation. Though when interacting with systemic size greater than 0,25; coefficients are estimated increasingly positive on market-to-book valuation. Suggesting that the most systemic banks are increasingly dependent on current state of public finances, consistent with a tendency towards the largest banks gradually approaching status as too big to save.

Banking in Europe has gone through vast changes the last 5 years, as illustrated by figures 4.A, 4.C and 2.C. The full consequences are not yet covered for, though evidence found in Regressions table 5.F suggests that large European banks after 2008 is priced significantly lower than its less systemic peers, both in terms of absolute size and in relative systemic size. This is very much in line with the tendency that the largest and most systemic banks actively reduce size. Some of this reduction of size might come as a result of banks being aware of their position as too big to fail gradually being overshadowed by status as too big to save.

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Appendix

Appendix 1 - List of analyzed banks

1	ABANKA VIPA D.D.
2	AGRICULTURAL BANK OF GREECE
3	AKBANK TURK AS
4	ALPHA BANK SA
5	ASYA KATILIM BANKSAI
6	ATTICA BANK SA
7	BANCA CARIGE SPA GEN & IMPER
8	BANCA COMERCIALA CARPATICA
9	BANCA FINNAT EURAMERICA SPA
10	BANCA MONTE DEI PASCHI SIENA
11	BANCA POPOLARE DI MILANO
12	BANCA POPOLARE DI SONDRIO
13	BANCA POPOLARE EMIL ROMAGNA
14	BANCA TRANSILVANIA SA
15	BANCO BPI SA
16	BANCO COMERCIAL PORTUGUES SA
17	BANCO DE CREDITO BALEAR SA
18	BANCO DE SABADELL SA
19	BANCO DE VALENCIA SA
20	BANCO DESIO DELLA BRIANZA
21	BANCO ESPIRITO SANTO SA
22	BANCO POPOLARE
23	BANCO POPULAR ESPANOL
24	BANCO SANTANDER SA
25	BANIF SGPS SA
26	BANK BPH S.A.
27	BANK COOP AG
28	BANK HANDLOWY W WARZAWIE SA
29	BANK LINTH LLB AG
30	BANK MILLENNIUM SA
31	BANK OF CYPRUS PUBLIC CO LTD
32	BANK OF GREECE
72	DEXIA SA
73	DNB ASA
74	DZ BANK POLSKA SA
75	EFG INTERNATIONAL
76	ERSTE GROUP BK AG
77	ESPIRITO SANTO FINANCIAL GRP
78	EUROBANK ERGASIAS SA
79	FINANSBANK
80	GETIN HOLDING SA
81	GETIN NOBLE BANK SA
82	GRAUBUENDNER KANTONALBK
83	HELLENIC BANK
84	HSBC BANK MALTA PLC
85	HSBC HLDGS PLC
86	IKB DEUTSCHE INDUSTRIEBANK
87	ING BANK SLASKI SA
88	INTESA SANPAOLO SPA
89	JULIUS BAER GRUPPE AG
90	JYSKE BANK
91	KBC ANCORA CVA
92	KBC GROUP NV
93	KOMERCNI BANKA AS
94	LANDESBANK BERLIN HOLDING AG
95	LLOYDS BANKING GROUP PLC
96	LOMBARD BANK MALTA
97	MDM BANK
98	MEDIOBANCA SPA
99	NATIONAL BANK OF GREECE
100	NATIXIS
101	NORDEA BANK AB
102	NORDEA BANK POLSKA SA
103	NOVA KREDITNA BANKA MARIBOR

33 BANK OF IRELAND
34 BANK OF MOSCOW
35 BANK OF VALLETTA LTD
36 BANK SARASIN & CIE AG
37 BANK URALSIB OJSC
38 BANKIA SA
39 BANKINTER
40 BANQUE CANTONALE DE GENEVE
41 BANQUE CANTONALE VAUDOISE
42 BANQUE NATIONALE DE BELGIQUE
43 BARCLAYS PLC
44 BASELLANDSCHAFT KANTONL
45 BASLER KANTONAL BANK
46 BBVA
47 BERNER KANTONALBANK
48 BK FUER TIROL VORARLBG
49 BNP PARIBAS
50 BNP PARIBAS BANK POLSKA SA
51 BRD-GROUPE SOCIETE GENERALE
52 BRE BANK SA
53 BULGARIAN AMERICAN CREDIT BANK
54 CAIXABANK SA
55 CAJA DE AHORROS DEL MEDITERR
56 CB CORP COMMERCIAL BANK AD
57 CENTRAL COOP BANK
58 CIC (CREDIT INDUSTRIEL COMM)
59 COMMERZBANK
60 CRCAM NORD
61 CREDIT AGRICOLE SA
62 CREDIT FONCIER DE MONACO SA
63 CREDIT SUISSE GROUP
64 CREDITO BERGAMASCO SPA
65 CREDITO EMILIANO SPA
66 CREDITO VALTELLINESE
67 CYPRUS POPULAR BANK PCL
68 DANSKE BANK AS
69 DENIZBANK A.S.
70 DEUTSCHE BANK AG
71 DEUTSCHE POSTBANK AG
104 OBERBANK AG
105 OLDENBURGISCHE LANDESBANK AG
106 OTP BANK LTD
107 PIRAEUS BANK SA
108 POHJOLA BANK PLC
109 POWSZECHNA KASA OSZCZEDNOSCI
110 PROBANKA
111 RAIFFEISEN BANK AVAL
112 RINGKJOBING LANDBOBANK A/S
113 ROSBANK OAO
114 ROYAL BANK OF SCOTLAND GROUP
115 SBERBANK OF RUSSIA OJSC
116 SEKENBANK TAS
117 SOCIETE GENERALE GROUP
118 SPAR NORD BANK A/S
119 SPAREBANK 1 SMN
120 SPAREBANK 1 SR BANK
121 ST GALLER KANTONALBANK
122 STANDARD CHARTERED PLC
123 SVENSKA HANDELSBANKEN
124 SWEDBANK AB
125 SYDBANK AS
126 TURKIYE GARANTI BANKASI AS
127 TURKIYE HALK BANKASI A.S.
128 TURKIYE IS BANKASI AS
129 TURKIYE SINAI KALKINMA BANKA
130 TURKIYE VAKIFLAR BANKASI
131 UBS AG
132 UNICREDIT SPA
133 UNIONE DI BANCHE ITALIANE
134 USB BANK PLC
135 VALIANT HOLDING AG
136 VAN LANSCHOT NV
137 VERWALTUNGS & PRIVATBNK
138 VTB BANK JSC
139 WALLISER KANTONALBANK
140 YAPI VE KREDI BANKASI AS
141 ZUGER KANTONAL BANK

Appendix 2: table of variables and its sources.

Variable name	Description	Data sources
Market-to-book	Market value of common equity divided by book value of common equity	Compustat
Liabilities	Liabilities total divided by GDP	Compustat and IMF
Assets	Natural logarithm of assets total, national currency	Compustat
Fiscal balance	Government revenues minus expenses, as a share of GDP	IMF
Leverage	Liabilities as a share of assets total	Compustat
GDP per capita	GDP per capita, in thousands of 2000USD	IMF
GDPgrowth	GDP growth in real terms, percentage points	IMF
Govspend	Government spending to GDP	IMF
Primary fiscal balance	Government revenues minus expenses and interest payments, as a share of GDP	IMF
Old-age dependency ratio	Number of people older than 64 years as a share of working age population	WDI
Openness	Sum of exports and imports, as a share of GDP	WDI and IMF
Sum Liabilities	Sum of bank liabilities in a country, as a share of GDP	OECD and IMF
Other Liabilities	Sum of the liabilities other banks in a country, as a share of GDP	OECD and IMF
Square Liabilities	Square of ratio of liabilities total divided by GDP	Compustat and IMF
Big01	Dummy variable that equals one if ratio of bank liabilities to GDP > 0.1, and zero otherwise	Compustat and IMF
Big025	Dummy variable that equals one if ratio of bank liabilities to GDP > 0.25, and zero otherwise	Compustat and IMF
Big05	Dummy variable that equals one if ratio of bank liabilities to GDP > 0.5, and zero otherwise	Compustat and IMF
Big1	Dummy variable that equals one if ratio of bank liabilities to GDP > 1, and zero otherwise	Compustat and IMF
Fee Income	Natural logarithm of non-interest income	Compustat
Pre-tax income	Pre-tax income, as a share of assets total	Compustat
Bank Asset Risk	Annualized standard deviation of daily dividend inclusive bank stock return, times the ratio of the market value of common equity to the book value of assets	Compustat
b1999	Dummy variable that equals one for all observations before year 2000, zero otherwise	Compustat
a2008	Dummy variable that equals one for all observations later than year 2007, zero otherwise	Compustat
e1999_2007	Dummy variable that equals one for all observations later than year 1999 and before year 2008, zero otherwise	Compustat

Bank balance sheet items gathered from Compustat Global – Fundamentals annual.

Bank market value and standard deviation gathered from Compustat Global – Securities daily.

WDI is the World Development Indicators, by the World Bank.

Data from IMF is found through World Economic Outlook database.

Data from OECD is found through OECD Banking Statistics.

Appendix 3: correlation matrix

	Market-to-book	Assets	Fiscal balance	Bank asset risk	Leverage
Market-to-book	1				
Assets	-0,04	1			
Fiscal balance	0,07	-0,18	1		
Bank asset risk	0,02	0,06	0,00	1	
Leverage	-0,05	0,24	0,02	0,00	1
Fee income	0,01	0,96	-0,18	0,06	0,14
Pre-tax income	0,29	-0,02	0,08	0,01	-0,46
GDP per capita	-0,26	-0,07	0,45	-0,01	0,18
GDP growth	0,36	0,03	0,23	0,00	0,10
Liabilities	-0,01	0,24	0,01	-0,01	0,21

	Fee income	Pre-tax income	GDP per capita	GDP growth	Liabilities
Fee income	1				
Pre-tax income	0,07	1			
GDP per capita	-0,15	-0,23	1		
GDP growth	0,06	0,29	-0,28	1	
Liabilities	0,19	-0,14	0,22	-0,09	1

Appendix 4 – Regression .do files

//Following package must be installed before performing the regressions: estout

net install estout, from(http://fmwww.bc.edu/RePEc/bocode/e)

//REGRESJON 5.A

eststo clear

eststo: regress pricebook Assets Fiscalbalance Liabilities, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance Liabilities ix1 BankAssetRisk leverage, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance Liabilities ix1 BankAssetRisk leverage FeeIncome PreTax, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance Liabilities ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth, cluster(ID)

esttab using Reg5A.csv, cells("b(fmt(3) label(Coef.)) t(fmt(a2) star)" se(fmt(3) par label(Std.err.))) stats(r2 N, fmt(3 0) labels(R-squared "N. of observations")) title("Market-to-book") varwidth(16) legend varlabels(_cons Constant ix1 BankAssetRisk*leverage) starlevels(* 0.1 ** 0.05 *** 0.01)

//REGRESJON 5.B

eststo clear

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth SumLiabilities, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Liabilities OtherLiabilities, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Liabilities SquareLiabilities, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Liabilities SquareLiabilities OtherLiabilities, cluster(ID)

esttab using Reg5B, cells("b(fmt(3) label(Coef.)) t(fmt(a2) star)" se(fmt(3) par label(Std.err.))) stats(r2 N, fmt(3 0) labels(R-squared "N. of observations")) title("Market-to-book") varwidth(16) legend varlabels(_cons Constant ix1 BankAssetRisk*leverage) starlevels(* 0.1 ** 0.05 *** 0.01)

//REGRESJON 5.C

eststo clear

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Liabilities, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Liabilities ix2, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Liabilities ix3, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Liabilities ix3 ix2, cluster(ID)

esttab using Reg5C, cells("b(fmt(3) label(Coef.)) t(fmt(a2) star)" se(fmt(3) par label(Std.err.))) stats(r2 N, fmt(3 0) labels(R-squared "N. of observations")) title("Market-to-book") varwidth(16) legend varlabels(_cons Constant ix1 BankAssetRisk*leverage) starlevels(* 0.1 ** 0.05 *** 0.01)

//REGRESJON 5.D

eststo clear

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Big01, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Big01 ix4, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Big01 ix41, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Big01 ix4 ix41, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Big025, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Big025 ix5, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Big025 ix51, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Big025 ix5 ix51, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Big05, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Big05 ix6, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Big05 ix61, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Big05 ix6 ix61, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Big1, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Big1 ix7, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Big1 ix71, cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Big1 ix7 ix71, cluster(ID)

esttab using Reg5D.csv, cells(b(fmt(3) star label(Coef.)) se(fmt(3) par label(Std.err.))) stats(r2 N, fmt(3 0) labels(R-squared "N. of observations")) title("Market-to-book") varwidth(16) legend varlabels(_cons Constant ix1 BankAssetRisk*leverage) starlevels(* 0.1 ** 0.05 *** 0.01)

//REGRESJON 5.E

eststo clear

eststo: regress pricebook Assets Govspend ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth SumLiabilities, robust

eststo: regress pricebook Assets Govspend ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Liabilities OtherLiabilities, robust

eststo: regress pricebook Assets Govspend ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Liabilities SquareLiabilities, robust

eststo: regress pricebook Assets Govspend ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Liabilities SquareLiabilities OtherLiabilities, robust

eststo: regress pricebook Assets Primarybalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth SumLiabilities, robust

eststo: regress pricebook Assets Primarybalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Liabilities OtherLiabilities, robust

eststo: regress pricebook Assets Primarybalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Liabilities SquareLiabilities, robust

eststo: regress pricebook Assets Primarybalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Liabilities SquareLiabilities OtherLiabilities, robust

esttab using Reg5E.csv, cells(b(fmt(3) star label(Coef.)) se(fmt(3) par label(Std.err.))) stats(r2 N, fmt(3 0) labels(R-squared "N. of observations")) title("Market-to-book") varwidth(16) legend varlabels(_cons Constant ix1 BankAssetRisk*leverage) starlevels(* 0.1 ** 0.05 *** 0.01)

//REGRESJON 5.F

eststo clear

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Liabilities c1999 ix8, robust cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Liabilities d2008 ix9, robust cluster(ID)

eststo: regress pricebook Assets Fiscalbalance ix1 BankAssetRisk leverage FeeIncome PreTax GDPcapita GDPgrowth Liabilities e1999_2007 ix10, robust cluster(ID)

esttab using Reg5F.csv, cells(b(fmt(3) star label(Coef.)) se(fmt(3) par label(Std.err.))) stats(r2 N, fmt(3 0) labels(R-squared "N. of observations")) title("Market-to-book") varwidth(16) legend varlabels(_cons Constant ix1 BankAssetRisk*leverage) starlevels(* 0.1 ** 0.05 *** 0.01)