Procyclical Effects of the banking System during the financial and economic Crisis 2007-2009: the Case of Europe

Nikolov, Pavel

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Erasmus University Rotterdam

Rotterdam School of Management

Department of Finance

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Pavel Nikolov

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Comments and remarks will be much appreciated. Please submit them to nikolov_p@abv.bg

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Abstract:

This paper examines the relationship between adverse shocks to the banking system and their effect on the general economy in Europe. This topic was brought to the spotlight during the 2007-2009 financial and economic crisis, when the relatively healthy, at that time, European economy was severely hit by the spread of the US sub-prime mortgage problems. This interbanking contagion may have been one of the main, if not the primary, reasons why the region entered into a recession during the period. If significant evidence can be found to support this theory, it will make the need for more regulations on the financial system and stricter capital requirements even more apparent. The research includes comprehensive literature survey on past and recent financial crises, procyclical banking practices and their impact on the economy. Then it goes on to developing a theoretical model of the transmission of negative economic shocks from the financial system to the rest of the economy. The theoretical model is empirically tested on a range of banking specific and macroeconomic variables. The results show that a loss of confidence in the financial system and banking losses are followed by a significant decrease in the new loans to non-financial companies and subsequent economic contraction. Moreover, countries with better capitalized banks experienced smaller declines during the crisis and in general Tier 1 capital is correlated positively with economic growth.

Key words: economic shocks, financial crisis, banking system stability, procyclical effects

1. Introduction:

Years after the start of the 2007-2009 financial crisis, it continues to impact the economies of a large number of countries through its long term effects, and it will certainly remain one of the most recurrent themes for economic research in the near future. Because of the large public discontent, one of the most important questions to answer is about the role of the banks in the financial crisis. However an attempt to present clear results about the US economy might prove to be overly complicated since there were many different negative economic factors that tend to multiply each other. Scholars at this time try to explain how the different issues such as securitization, CEOs' incentives, government housing policies and the measures taken or not taken contributed to the biggest economic downturn since the Great Depression in the United States. Nevertheless some European countries like the United Kingdom experienced financial problems equal, if not bigger, than the ones in the country of origin of the crisis, simply because the banks there held a certain amount of US mortgage-backed securities and they are connected to the global financial markets. That is why this research paper concentrates on the European troubles during the 2007/2009 financial crisis that undeservingly received less attention by the academics. The main goal of the study is to isolate the transmission mechanism of shocks from the banking sector to the real economy and the resulting decline in aggregate output. Eventually this will shed light on the true role of banks in the financial crisis.

Currently we know that the problems in the United States started when after a long run, the housing prices began to decline. At that point the growth of the American economy has already slowed down considerably. Up to this time banks that lent to subprime borrowers faced relatively low risk, since even they were unable to continue paying the mortgage, the bank could simply foreclose the property and quickly resale it, even at a profit. The widespread practice of securitization and the deterioration of lending standards, which was partially encouraged by the government's housing policy and the quasi-federal agencies FNMA and FHLMC, led to broad financial contagion. What followed was a typical liquidity spiral that started with decreasing prices of the assets on the banks' balance sheets. Financial institutions quickly responded by decrease in lending, exacerbated by the mutual distrust of banks that held mortgage-backed securities, further depressing the prices of the assets. However these simultaneous, mutually enhancing effects do not allow us to determine with certainty the responsibility of the banks. Nevertheless we can say with a degree of confidence that in Europe the recession was imported through the banking system and later affected the

real economy, causing the recession here. A smaller topic within the research question is about the cause and the consequences of the loss of confidence and the crunch in the interbank lending market in the euro area. It directly impacted the normal functioning of the financial system. Another such issue was the abrupt stop in the lending to the firms and the households. It started an asset market feedback loop and caused the canceling of investment decision and even the bankruptcy of many liquidity constrained firms. The radical shift in monetary and fiscal policy proved to be only moderately helpful since the rise of uncertainty induced the banks to build up excess reserves in anticipation of further decline.

This topic is particularly relevant from several perspectives. First of all, from a scholarly point of view, the research will summarize the current body of knowledge on financial crises and their relationship with the economy, and will make parallels to the situation in Europe nowadays. At the end it should answer the question whether the financial calamities of the past several years are unique, unprecedented event for which the regulators and the policymakers could not have prepared in advance, or are there comparable historical events that should have served as guidance during the crisis. The research will also contribute to the exiting literature on the subject by presenting a very simple theoretical model of how negative shocks to the banking system end up influencing the investment decisions by firms. It will also attempt to measure this shock and its consequences in the European countries during the period 2007-2009 by regressing change in GDP on several banks specific and macroeconomic variables related to the financial crisis. The results show that loss of confidence in the financial system has a real impact on the aggregate output of the economy. In addition expectations of the banking managers about the future state of the economy have actual causal implications for it. Moreover, countries with better capitalized banking systems seem to be more resilient to negative shocks in bad states of the economy and to have a higher growth rate in good states.

The next section will be a brief overview of the subprime mortgage crisis in the USA and how it was transmitted to Europe. Section 3 will summarize the existing body of knowledge on financial crises, banking failures, liquidity spirals and their relationship to the European experience. Section 4 will present a small theoretical model of the transmission of adverse shocks from the financial system to the general economy. Section 5 is an empirical model, designed to test some of the assumptions of the theoretical background. The results of the test will be given in the following section - 6. Section 7 is a brief conclusion.

2. US Subprime Mortgage Crisis and the European Contagion:

Today we can say with certainty that the economic and financial problems that would later develop into the biggest global recessions since the 1930s, began after the housing prices in the United States started to decline, following almost a decade of continuous rising. At that time the growth of the US economy had already slowed down noticeably and in the early spring of 2007 the former chairman of the Federal Reserve predicted that there is a considerable chance of a recession by the end of that year. As Reinhart and Rogoff (2008) point out, the initial bubble in housing prices was not recognized by the majority of analysts until after it burst and the historically high prices were justified and deemed to be sustainable because of the financial innovations, such as the subprime mortgages, and the steady inflow of cash from petrodollars and the Asian exporters, such as China. Therefore in order to answer the question what the role of banks in the financial crisis was, it is useful to separate the causes and preconditions leading to it that can and cannot be attributed directly to the financial system. The terms banks, banking system and financial system will be used interchangeably from now on since the banks are by far the biggest players in the financial system, there is decreasingly less difference between the activities in which each type of institutions is involved and, as explained later, the whole system tends to act in a similar manner when exposed to shocks.

2.1 Monetary Policy, CEO's Incentives and Banking Practices

The roots of the housing bubble can be traced back to the loose monetary policy following the East Asian and Russian financial crises in the late 1990s, the attacks on 9/11, as well as the US government programs on housing. Taylor (2009) and Taylor and Williams (2009) argue that the long period of excessively low interest rates created an inflationary pressure on asset prices, especially real estate, and impacted the savings rate of the United States while fueling consumption, and this excess was the main cause of the initial boom and the subsequent demise. Taylor (2009) presents the results of a statistical model of what the housing starts would have been if the Federal Reserve had followed the Taylor rule when conducting monetary policy. His conclusion is that the application of the well-known rule named after him would result in between 300k and 1 million new housing units less built each year between 2002 and 2006. Nevertheless, we should always remember that Alan Greenspan was consistently praised for his policies and foresight until the events in 2007-2009. The housing bubble was also aggravated by the actions of the quasi-federal agencies FNMA and FHLMC, which were strongly encouraged to buy mortgage-backed securities, particularly the

ones generated from sub-prime lending, while both they and the credit rating agencies who rated the securities severely underestimated their risk (Taylor, 2009).

Nevertheless, these issues are of technical nature and took so long to develop into a real problem that they may remain largely unnoticed outside the academia. Since the problems first appear on the banks' balance sheets and eventually led to many bank bailouts by the governments around world, the general public was largely left with the impression that the 'greedy' banking managers were purposefully involved in an excessive risk taking in order to extract private gains, e.g. performance bonuses. However the issue of moral hazard in the banking sector may not be as pronounced as many believe. Fahlenbrah and Stultz (2009) find no evidence that the banks of CEOs who had their incentives better aligned with the interests of the shareholders performed better during the crisis, nor that the manager who owned stakes tried to decrease their holdings in anticipation of the crisis or to hedge in any way. They conclude that the crisis came largely unexpected to the top managers as well, who also suffered large losses. As a matter of fact, there are even some evidence that banks with pro-shareholders board or better governance as measured by the Corporate Governance Quotient suffered relatively larger losses during that period (Beltratti and Sutltz, 2009). Both Fahlenbrah and Stultz (2009) and Beltratti and Sutltz (2009) conclude that managers took actions that they believed would be welcomed by the markets and the shareholders, while others even claim that risk taking by a bank is positively related to the power of shareholders in the governance (Laeven and Levine, 2009).

Wrong incentives of the banking managers might not have caused the financial crisis, but other developments of the banking systems certainly contributed to its severity. Such issues were the decline of the traditional banking model brought by the increasing preference for the "originate-and-distribute" banking, securitization of loans and substitution of the conventional retail deposits financing with increasing reliance on wholesale funding. The high demand for mortgage-backed securities induced sub-optimal underwriting standards by the banks, which were trying to meet the demand (Laeven and Valencia, 2009). With these securities banks created and sold structured products in order to transfer risk to the parties that were able to bear it better, such as long-term institutional investors, but substantial amount of CDOs were kept on balance sheet, especially in the high risk tranches, as a signal of appropriate monitoring of the loans (e.g., Brunnermeier, 2009; Kashyap et al., 2008). Thus the problem may not be in the post-issue monitoring, but rather in the quality of loans by banks.

Despite the fact that when implemented properly, with high underwriting standards and accurate risk assessment, the practice is not problematic by itself, Demirguc-Kunt and Huizinga (2009) discovered that increasing reliance on non-interest generating activities in banking system, such as trading, may increase its fragility. However they do not attempt to explain why this might be the case or whether it is connected to the generate-and-distribute model. Moreover, according to the Basel I accords banks have to hold at least 8% capital for the mortgages on their balance sheet, but they are not required to hold any capital for structured products in off-balance sheet entities under certain conditions (Brunnermeier, 2009). Thus the incentive for securitization and relocation of the mortgages is clear, but this happens at the expense of the capital cushion that is imposed by the regulators to absorb unexpected loses. This is a form of regulatory arbitrage, which can certainly be profitable in good times but has a questionable effect during financial crises. Another support for this hypothesis gives the result by Beltratti and Stulz (2009) that the most profitable banks immediately before the crisis suffered the most during 2007-2009. However, these are all circumstantial evidence that deserve further research.

2.2 Market Failure and Contagion

Even given the developments in the banking system described in the previous part and the macroeconomic imbalances in the United Stated that will be again addressed later, the size and the severity of the financial crisis are still somewhat surprising. The initial problems of the banks seemed isolated and arose only in the subprime segment of the market. Even 3 years after the beginning of the subprime mortgage crisis the total losses for the banks brought by the actual developments in the real-estate lending cannot be calculated with enough precision. In October 2008, the International Monetary fund has predicted $750 billion of losses related to the housing market, about $500 billion of which were attributed to the subprime mortgage backed securities (e.g., IMF, 2008; Hellwig, 2009). Nevertheless, their estimate appears overly conservative as the total amount of these securities outstanding in the beginning of the crisis was only $1,1 trillion, and the average drop in the housing prices from their peak has been only 19% (Hellwig, 2009). Moreover, the average rate of mortgages in foreclosure or at least 30 days delinquent has reached a peak of only 14,41% at the end of 2009 as reported by Mortgage Bankers Association. Although the numbers are certainly worrying, they show that the collapse of the housing market cannot explain the size of the predicted losses, and not even the most conservative the estimates of the IMF ($750 billion) can account for the $8 trillion of wealth lost globally (e.g, Brunnermeier, 2009).

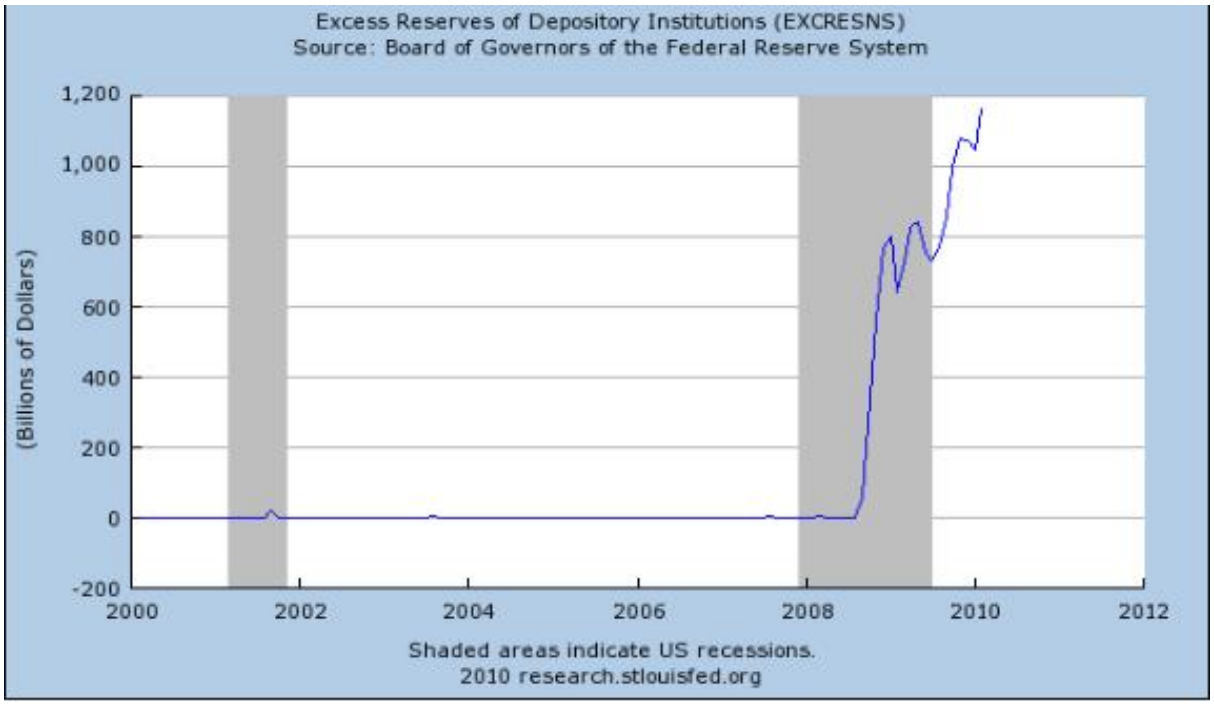
The reason for the difference between the banking losses calculated from the housing market fundamentals and the prediction of the International Monetary Fund is that the later is actually not based on these fundamentals. IMF estimates are made on the basis of the market valuation of the mortgage backed securities and when the market for those securities virtually broke down their price fell considerably below the expected present value of the associated cash flows (Hellwig, 2009). The rationale behind this is that when these loans are held in the form of tradable securities, and thus constantly marked-to-market, any price movement immediately shows as a change of net worth (Adrian and Shin, 2008). This led to the banks writing off several hundred billion of assets and announcing massive losses. Even in this case the financial crisis may have been contained if it was not for the way banks invested in the MBS. As mentioned before, many mortgages were transferred to structured investment vehicles to exploit the lower capital requirements. The SIVs on the other hand were financed with very short term borrowing, collateralized with their holdings of MBS, and needed to roll their liabilities up to several times a year (Shin, 2009). Faced with losses and falling value of the collateral, the SIVs were forced to sell the assets they could not refinance, further depressing the value of the MBS in a vicious spiral (Kashyap et. al., 2008).

Because of this process the market price of the MBS fell below their fundamental value, but since many investors started questioning their quality there were no arbitrageurs willing to take the risk and intervene. This created persistent short-term funding problems for many institutions that when faced with uncertainty chose to hold their liquidity and exacerbated the problem (Kashyap et. al., 2008). The shock to the perceived risk in the system was further aggravated by the indecisive actions of the US authorities, which supported some banks, but allowed others, like Lehman Brothers, to fail contributing counterparty risk to the already existing problems (Taylor, 2009). These conditions quickly transferred to Europe, which in general did not suffer from the macroeconomic imbalances that made the USA prone to financial crises. Nevertheless the liquidity shortage and the counterparty risk affected the European intuitions that followed the same financing and investment model (Shin, 2009). The curious development was that the European financial crisis also affected banks severely. Such was the case of Northern Rock in Great Britain, which held virtually no subprime mortgages or US MBS, but relied heavily on a short-term wholesale financing from the same pool of liquidity as the SIVs (Shin, 2009). Virtually all of the major European banks suffered losses and wrote down assets because of their exposure to the global markets, inducing the European governments to intervene and bail them out in a similar manner as in the USA.

2.3 Monetary Policy during the Financial Crisis

From financial point of view the credit crunch has been caused by the large losses of the financial institutions that affected their ability to borrow and create liquidity. Thus, it is not surprising that the main instrument for intervention of the central banks around the world was to lower the short-term interest rates and introduce unprecedented capital injections into the markets. Despite the large inflows, the banking institutions were still trying to preserve their liquidity and cut-back on the lending to the real economy, transferring the funding problems to the other businesses (Kashyap et. al., 2008). As can be seen on Figure 1 below, the monetary policy may have prevented more banking failures, but it proved largely ineffective in countering the real consequences of the financial crisis and its development into a global recession. One explanation of this may be the nature of the crisis, as Kashyap and Stein (2000) and Berger and Bouwman (2009) have both found that monetary policy is most effective for small banks and banks with illiquid balance sheets. Furthermore, Berger and Bouwman (2009) argue that liquidity creation by the large banks that account for 90% of the loans to the businesses, was not affected significantly my monetary policy during 2007-2009, but they provide no explanation for their observation. However, as the models in the later sections suggest, if the shock to the perceived risk in the economy is large enough, banks will temporarily suspend lending and build cushions against unexpected future losses, thus having a further procyclical impact on the economy.

Figure 1: Excess Reserves in the US Banking System



3. Financial Crises and Procyclical Effects of the Banking System

3.1 Financial Crises around the World

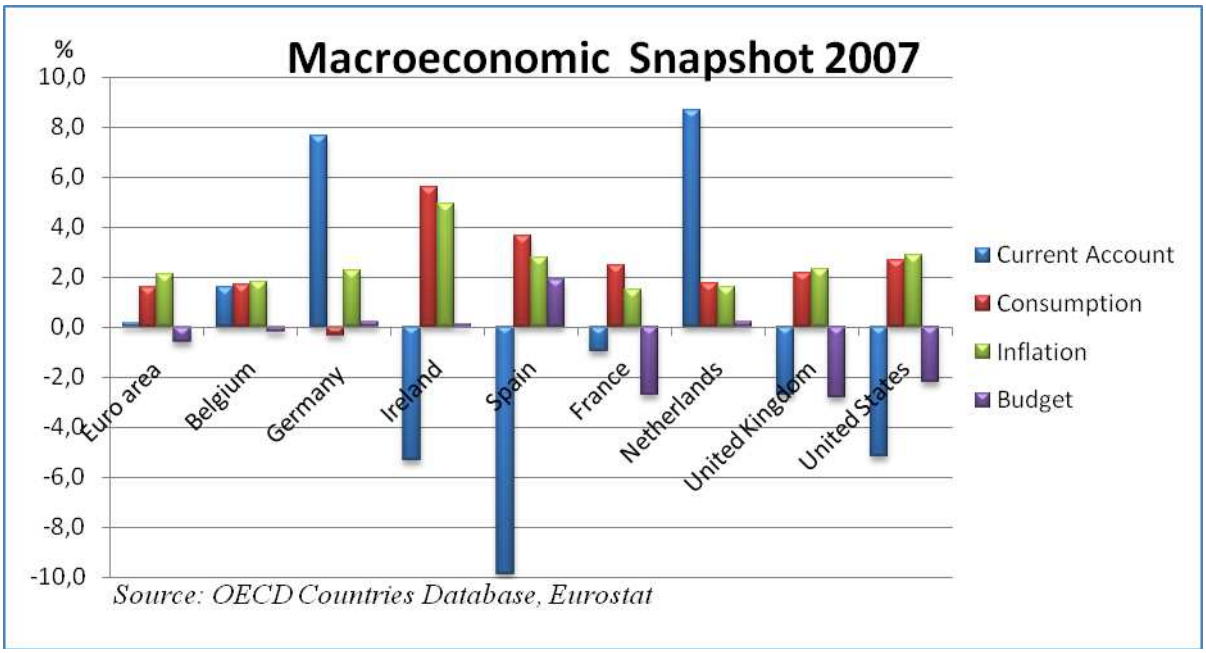
Although the recent financial crisis was the biggest since the turbulence of the 1930s, its manifestation, at least in the United States, was not an unprecedented, one of a kind event, as the general public was made to believe. First of all, from a historical point of view different financial crises and banking panics were quite commonplace through the IX and XX centuries and even in the last decade alone we experienced the crash of the dot-com bubble and the subprime mortgage crisis. Even though every crisis appears to be different on the surface, almost always there are certain macroeconomic conditions that lead to building up of critical imbalances that subsequently trigger some form of financial disaster. In nearly every case, however, the banking system plays a critical role in both the initial accumulation of economic instability and later seems to be decisive for the containment or transmission of the shock to the rest of the economy. The theory examined in this research is that the financial system prolongs and magnifies the typical economic boom preceding the crisis and then when faced with a big enough, sudden shock to the risk in it, contracts the credit supply to the real economy, amplifying the downturn.

Although severe financial crises in the past were more typical for developing economies, often with fixed exchange rates like Chile in 1980 and Mexico in 1994 (Edwards and Vegh, 1997), they did not spare even some of the wealthiest countries like Finland and Sweden in the 1990s (Reinhart and Rogoff, 2008). The conditions prior to them are usually characterized by extraordinarily strong economic expansion, large current account and budget deficits and excessive credit boom (e.g., Laeven and Valencia, 2009; Reinhart and Rogoff, 2008). The so called twin deficits are especially indicative of future economic problems. They are always financed by strong capital inflows from abroad that fuel consumption boom (Edwards and Vegh, 1997). Berger and Bouwman (2009) find that in these conditions the liquidity creation by the banks is extraordinarily high, which is related to the credit expansion. Therefore, banks not only channel the capital inflows from abroad, but tend to amplify them by taking more risk. This leads to even higher consumption and inflation, an increase in housing prices and a run-up in the equity markets (Reinhart and Rogoff, 2008). Reinhart and Rogoff (2008) also claim that maturity mismatch is one of the preconditions for financial crisis, but it is always present in the financial system so it will be further examined in the later parts of the paper. In any case it seems that the economy of the United States before the subprime problems fulfilled all preconditions for the typical financial crisis.

Even though at the dawn of the subprime mortgage crash the United States looked like the "archetypical crisis country" according to Reinhart and Rogoff (2008:340), it is much more difficult to explain why the finical crisis spread around the world. Here we have to make a distinction between the global economic downturn, which is not unusual given the influence of the USA on the global economy, and the structural problems in the financial systems that caused banking failures, credit crunch and loss of confidence in Europe. As a matter of fact there are evidence that at least the early stages of the recession in Europe were also caused by the financial system, and did not transfer through the typical channels of contagion such as trade and investments (more about it in section 6). On Figure 2 below is given a comparison between the United States and several European countries at the end of 2007, based on the some of the macroeconomic variables associated with financial crises as discussed above.

We can clearly see that the Euro Area as a whole appears stable and the only country suffering from substantial twin deficits is the United Kingdom. Therefore with the standard macroeconomic analysis we cannot explain why financial problems emerged in some of the countries like Germany, Netherlands and Belgium that had surpluses and low inflation environment. On the other hand the financial sector of Spain, which certainly appears the most the vulnerable country in Euro Area, was relatively not affected. Thus it follows that these imbalances are neither necessary, nor a sufficient condition for a financial crisis in a given country. Moreover its emergence and the transmission of the shock to the real economy may depend to a large extent on the banking system itself.

Figure 2: Macroeconomic Snapshot in 2007



3.2 Procyclical Effects of the Financial System

In order to answer the question why the financial crisis transferred from the United States to the seemingly healthy European economies we need to examine more thoroughly the operations of the banking system. A bank is usually defined as a financial institution that collects deposits from the households and business and uses them to provide loans back to these parties. Kashyap et. al. (2002) claims that deposit taking and lending are the two expressions of the one fundamental banking activity – providing liquidity on demand. As a matter of fact, the whole financial system is built around this provision of liquidity, which is essential for the normal functioning of the economy. In the economic literature there are strong evidence that the level of development of the banking sector, as well as size and the liquidity of its financial markets, are positively correlated with future economic growth (e.g, Beck et. al., 2000). King and Levine (1993) also find that financial development is positively correlated with present and future rates of GDP growth, physical capital accumulation and efficiency of capital allocation. Nevertheless, the so called financial deepening is not only a source of economic growth. As we currently witness, in some rare cases it may transform into a cause of instability and be even detrimental for the economic activity by amplifying and sometimes even causing the swings of the economic cycle.

Since the banks collect deposits, a liability on their balance sheet, and use them to provide loans, which enter as assets, they tend to be very leveraged institutions. For example, at the end of 2009 the ratio of capital and disclosed reserves to total assets in the European banking system (the so called Tier1 capital ratio) was only 6,15% and this is the highest observed value in the last decade. As a matter of fact, the financial system as a whole is similarly leveraged as it is largely financed with some form of liabilities. However, if the assets side of the balance sheet is constantly marked-to-market, as the fair value accounting principles require, any negative change in the price of the assets shows immediately as a change in the net worth of the financial intermediary, inducing a reaction by the institution (e.g, Adrian and Shin, 2008). Since the capital is such a small percentage of the assets, and there are strict capital requirements, the appropriate response is naturally to decrease the leverage to minimize further losses. Thus Adrian and Shin (2008a) and Adrian and Shin (2009) find that level of leverage of the banks is very procyclical, increasing during booms and dramatically decreasing during recessions, and positively correlated with the level of marking-to-market and the size of the balance sheet. However this has implications not only for the banks themselves, but has aggregate consequences as well.

Since the banking system, as a whole, has an exposure to the same types of assets, the probability that when one bank is experiencing gains or losses at a given point in time, its competitors are similarly gaining or losing is quite high. Therefore, the observations about the procyclical leverage and its relation to balance sheet size holds also for the entire financial system (Adrian and Shin, 2008a). As mentioned above, when the assets prices are falling the bank will try to decrease leverage, which can be achieved in one of three ways – by selling assets, by issuing more capital or in a combination of the two (Adrian and Shin, 2008b). However, issuing additional capital is relatively slow process and in general cannot be used in day to day risk management. Selling off of assets, on the other hand, increases the volatility and decreases the price of the securities even if it is not a coordinated act by the financial intermediaries, but individual decision caused by the market circumstances. This may create a perception of increased risk on the markets and will be picked by the risk measures such as Value at Risk. For this reason Adrian and Shin, (2008b) claim that such risk management tools create spillover effects to other financial institutions and that the increased perception of risk decreases the debt capacity in the entire financial system, causing further deleveraging by the financial intermediaries.

This behavior of the banks resembles somewhat the manner of operation of traders and investment firms that use leverage and margins. However the business of banks, as stated previously, is to create liquidity by financing relatively illiquid, long term assets, such as loans, with liquid short term liabilities, like demand deposits, commercial paper and repos (e.g, Adrian and Shin, 2008; Berger and Bouwman, 2009). The creation of liquidity, on the other hand, is implicitly related with the leverage of the financial system, especially during times of negative shocks. If the banks use their assets as collateral when borrowing, the implicit “margins” in the banking system may lead to mutually reinforcing effects of the funding liquidity, measured by the ease of borrowing, and asset market liquidity and volatility (Brunnermeier and Pedersen, 2008). According to Brunnermeier and Pedersen (2008), the financial intermediaries will be induced to sell their holdings of assets, which will decrease the prices of those assets, further impacting their ability to borrow in the so called liquidity spiral. This interaction between funding liquidity and asset prices is a strong transmission mechanism that can amplify and propagate shocks through the financial system (e.g, Kyotaki and Moore, 1997; Adrian and Shin 2008b). Therefore the liquidity that the banking system provides is also procyclical, high during booms and low during recession, and it is especially sensitive to balance sheet shocks.

In any case, the fact that the financial system has maturity mismatch makes it very susceptible to liquidity problems, or as Adrian and Shin (2009: 604) put it - "any tensions resulting from a sharp pullback in leverage will show up somewhere in the system". If banks are concerned about a possible failure of rolling their short-term liabilities they will attempt a rapid deleveraging and the interbank lending channel will dry up (Brunnermeier, 2009). This will further aggravate the level of liquidity on the market and will create serious problem for the more constrained institutions. However, there are evidence in the literature that the excessive liquidity creation (Berger and Bouwman, 2009) and disproportionately high maturity transformation (Hellwig, 2009), which are both very pronounced during economic booms, increase the vulnerability of the financial system to the adverse conditions described above. Foos et. al. (2010) also find that abnormal loan growth lead to weakening of the individual intermediaries' risk-return structure. Further support for the theory of procyclical liquidity and leverage is given by Brunnermeier and Pedersen (2008) who find that reduction in capital and unexpected shock to losses impacts market liquidity negatively and may lead to spiraling drop in it. As a matter of fact, this is exactly what we observed during the 2007-2009 financial crisis, but the actual problems for the economy started when the financing issues of the banks spilled over to their borrowers, the non-financial businesses (Kashyap et. al., 2008).

According to both the standard Real Business Cycle theory and the classical Keynesian IS/LM model, the developments in the financial markets have no impact on the real-economy (Bernanke et. al., 1998). However large losses of the financial intermediaries and liquidity crunches on the interbank markets are equivalent to aggregate monetary contraction, which is followed by flight to quality (Caballero and Krishnamurthy, 2007) and decline in the total banking lending (Kashyap and Stein, 2000). Thus according to the financial accelerator theory, introduced by Bernake et. al, (1996), some small real or, as in our case, monetary shock will be amplified and spread throughout the economy by the credit market conditions, generating over-proportional fluctuations in output. The reason is that in the presence of asymmetric information between the borrower and the lender, the initial shock to the economy also impacts the agency cost of lending, and thus the price of external finance (Bernake et. al., 1996, 1998). Agency costs affect the risk premiums making them countercyclical, which amplifies the swing in borrowing, investments and production (Bernanke et. al., 1998). Tightening credit conditions affect the most poorly capitalized firms (Holmstrom and Tirole, 1997) and small firms (Bernake et. al., 1996), which is consistent with the theory of increased agency costs. Because of the increase in premiums, however,

there is a potential causal relationship running from the perception of increased risks of lending to an actual growth in defaults and delinquencies in the future.

Nevertheless, in the academia not everybody agrees with the financial accelerator theory. Gatev and Strahan (2006) claim that when the liquidity on the market is low and the spreads are wide, the banks will experience increase in deposits due to their relatively low risk profile, and will effectively substitute credit from other sources. This will not be the case, however, if the banks are under stress as well, which is the case during financial crises. Borio et. al. (2001), on the other hand, accept the effect of higher information asymmetries during bad times, but argue that the financial accelerator is not sufficient to explain the wide drop in output induced by adverse shocks to the financial system. Their theory suggests that financial institutions consistently misjudge the level of risk in the economy over time because of behavioral biases such as disaster myopia and cognitive dissonance. As an evidence for this, the authors refer to the procyclical credit ratings, despite the effort of agencies to grade through the cycle. Thus, during good time the risk is underestimated, which fuels credit growth and consumption, and overestimated during downturns, impeding the recovery and preventing even borrowers with profitable projects to obtain financing (Borio et. al., 2001). Furthermore, Foos et. al., (2010) argue that abnormal loan growth on individual level is linked to looser credit standards and is associated positively with higher risk and loan losses, and negatively with future profitability and solvency. Thus financial institutions may have a substantial causal impact on the swing of the business cycle.

As we see, the developments in the world economy during 2007-2009 are definitely not exceptional and are easily explained by the decades of economic research and examinations of financial crises. During this period we observed both troubles in the undercapitalized shadow banking institutions, financed with short term borrowing (Shin, 2009) and banks unwilling to credit each other because of the sudden increase in risk (Taylor and Williams, 2009). In these circumstances the European banking system, which is indivisible part of the global financial markets, brought the financial crisis in Europe, despite the fact that there were no negative macroeconomic conditions to justify the financial contagion here. Moreover because of the large losses of the banking institutions and the expectations that the severe recession already present in the United States will certainly impact Europe, they reacted preemptively to the risk by cutting lending to the real economy and effectively pushing it into a recession. Further evidence for these effects are given by the empirical results in Section 6.

3.3 Regulations and Capital Requirements

Another look at the regulations and capital requirements of the financial system may tell us more about the means to avoid such market disasters in future. In addition, it will also give further support to the theory of procyclical banking activities during the financial crisis. As stated previously, there is no evidence that "greed" or any form of opportunistic behavior by top banking managers is responsible for the excessive exposure to ambiguous structured products prior to the crisis. In addition, there is also no evidence that compensation through option had any effect on risk taking by the top managers, as measured by stock volatility (Fahlenbrah and Stultz, 2009). Therefore, regulators that are currently examining or trying to restrict executive pay in some form may be missing the point, unless they are simply trying to address the public discontent with the high salaries.

On the other hand, Laeven and Levine (2009) demonstrate that risk taking by the banks is positively related to the shareholders concentration and power over the executives. In such highly leveraged institutions, this behavior is largely consistent with the seminal work of Jensen and Meckling (1976) and the predicted by them moral hazard of gambling with borrowed money. In this situation capital requirements may help to alleviate the agency problems by preventing the owners from undertaking excessively risky investments, because the events of losses become more costly to them (Morrison and White, 2005). Beltatti and Stultz (2009) find positive effect of strict capital requirements on banking performance during the financial crisis, while Barth et. al., (2004) shows insignificant relationship between capital and crises but strong negative correlation with non-performing loans.

Except for capital, the results about all other regulatory practices in the literature are mixed. Laeven and Levine (2009) find that effect of regulation on risk taking depends on the ownership concentration. Demirguc-Kunt et. al. (2003) also present no significant results about regulation when controlling for national indicators of economic freedom and property rights, but find negative impact on efficiency of intermediation when regulations impede competition. Barth et. al, (2004) argue that restriction on activities is correlated inversely with development, diversification and stability, in contrast to Beltratti and Sultz (2009) which find that banks in countries with some restrictions performed better during the crisis. In addition, Foos et. al. (2010) suggest that authorities should also monitor carefully loan growth as an indicator of riskiness of the financial institutions. In any case, more research is needed in this area. The next section will present a theoretical model consistent with the findings so far.

4. Theoretical Model of Spillover effect due to adverse shock to the perceived risk in the economy

This theoretical model is used to explain why and how an adverse shock to the financial system in a country can spread to the rest of the economy, effectively causing the whole economy to underperform. It uses a risk management approach to clarify why banks tend to abruptly cut lending and increase interest rates when expected future losses and uncertainty about the amount of those losses increase. At the same times even profitable companies that had positive net present value opportunities before the shock in the financial system face higher cost of capital. This forces them to either cancel or if possible delay investment decisions. Building excess reserves in bad times was especially evident in the 2007-2009 financial crisis and was one of the major reasons why monetary policy and fiscal stimuli were not as effective as the policymakers would have liked.

Let us assume a perfectly competitive banking market, where all banks are atomistic and can supply unlimited quantity of loans at the current interest rate prevailing on the market. Banks have two types of assets: **M –** money, liquid asset, and **L** – loans, illiquid asset, and one type of liability: **D –** deposits. Therefore for any given time period **t** the balance sheet of any bank will have the form:

$$\pi_{t-1} + D_{t-1} = M_t + L_t \qquad \textbf{(1)}$$

Assets	**Liabilities and Retained Earnings**
$\mathbf{M_t}$	$\mathbf{D_{t-1}}$
$\mathbf{L_t}$	$\boldsymbol{\pi_{t-1}}$

Where $\boldsymbol{\pi_{t-1}}$ is the profit on loans from the previous $\boldsymbol{\pi_{t-1}= i_L.L_{t-1}}$. Let is assume that in the beginning of period **t** the given bank starts with loans equal to $\mathbf{L_t}$ and money/liquid asset $\mathbf{M_t=0}$. At the end of the operating period the bank is left with net positive cash flow from deposits equal to $\mathbf{M_t}$; the bank attracted more deposits than were withdrawn during the period. Then the bank has to decide how the split the liquid asset $\mathbf{M_t}$ between money and loans for the next period so that:

$$M_t^E = M_{t+1}^B + L_{add} \qquad \textbf{(2)}$$

In the beginning of every period the banks has a fixed cash outflow equal to **F** which is related to costs and withdrawn deposits. The assumption of fixed cash outflows is not very realistic but we use it for simplicity of calculation only. If relaxed, it will actually support the theoretical results further by inducing even more conservative behavior on the part of the banks. In the beginning of t+1 the bank will also receive interest on its old loans equal to $\mathbf{i_L.L_t}$. Budgeted cash flow for the beginning of t+1:

$$C_{t+1} = M_{t+1} + i.L_t - F \qquad \textbf{(3)}$$

The bank would like to minimize its holding of liquid assets because they bring no interest and give out as many loans as possible since it is a price taker. However if

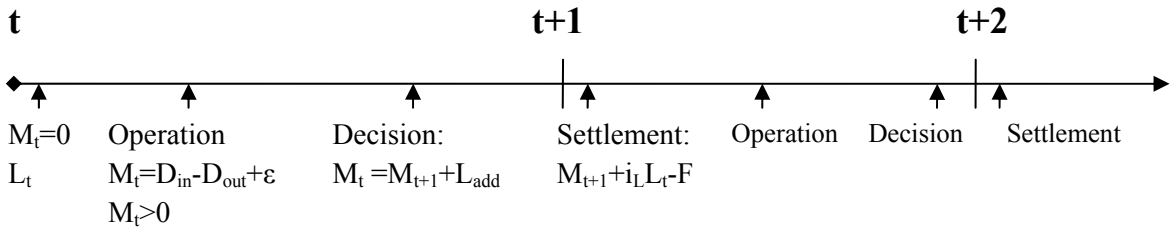
$$F > M_{t+1} + i.L_t \qquad \textbf{(4)}$$

the bank will be in distress and will experience liquidity problems. We further assume that in order to resolve the problem, the bank can either borrow or sell part of the illiquid assets at a discount, but in any case there are high costs involved. Therefore the banks will have strong incentive to minimize potential liquidity problems. If there is absolute certainty about the interest income from loans it can split M_t exactly to $M_t = M_{t+1} + L_{add}$ so that:

$$F = M_{t+1} + i.L_t \qquad \textbf{(5)}$$

By doing this the bank will both maximize profits and eliminate any potential costs of distress. For a better understanding of the decision process, the order of operations is represented visually on Figure 1 below. The model is related more to a strategic planning of reserves and capital adequacy rather than to day-to-day decisions.

Figure 3: Timeline of Operations



However there is a proportion of the loans **L,** equal to δ_t , that will turn out to be a bad debt and will not pay interest. Thus the expected cash flow in the beginning of a period becomes:

$$C_t = M_t + i.(1-\delta_t).L_{t-1} - F \qquad \textbf{(6)}$$

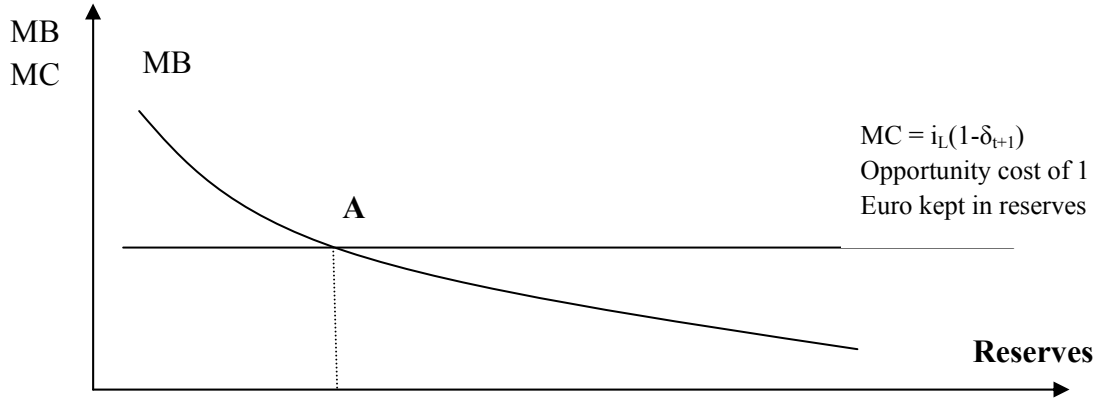
Still profits can be maximized if $F = M_t + i.(1-\delta_t).L_{t-1}$, but δ_t has to be known with certainty. The bank needs also to make provisions for the bad loans as soon as they are known and the new strategic decision becomes:

$$M_t^E = M_{t+1}^B + L_{add} + \delta_t.L_t \qquad \textbf{(7)}$$

Money, at the end of period t, has to be split between beginning balance of money for the next period, additional loans and provisions for the bad debt that became known during t.

Furthermore we assume that the proportion of bad debt δ_t is not constant, but rather an approximately normally distributed random variable $\delta \sim N(\mu, \sigma^2)$. This will force the bank to keep more cash into liquid assets in order to avoid costly distress. Thus for a given expected level of δ for the next period, the banks will retain cash at least equal to $E(\mu).L$. However this will prove to be a costly strategy since the true value of δ will be higher than $E(\mu)$ 50% of the time and we can readily accept that the cost of financial distress on average is higher than the profit earned on loans so that good states do not compensate for the equal number of bad states. Therefore the bank will hoard liquid assets until the marginal benefit of an additional Euro kept in **M** equals the opportunity cost of the same Euro given off as loans, which is $i_L(1-\delta_{t+1})$ due to the competitive market assumption (on Figure 2 below).

Figure 4: Optimal Level of Reserves



The bank will choose to build up its reserves of liquid assets until point A, where the marginal benefit of the liquid assets equal their marginal opportunity cost. After this point it becomes too costly for the bank to lower its risk further.

The marginal benefit of a Euro kept in money equal the marginal cost of distress - **K,** such that:

$$K_t = f(S, \delta_t) \qquad \textbf{(8)}$$

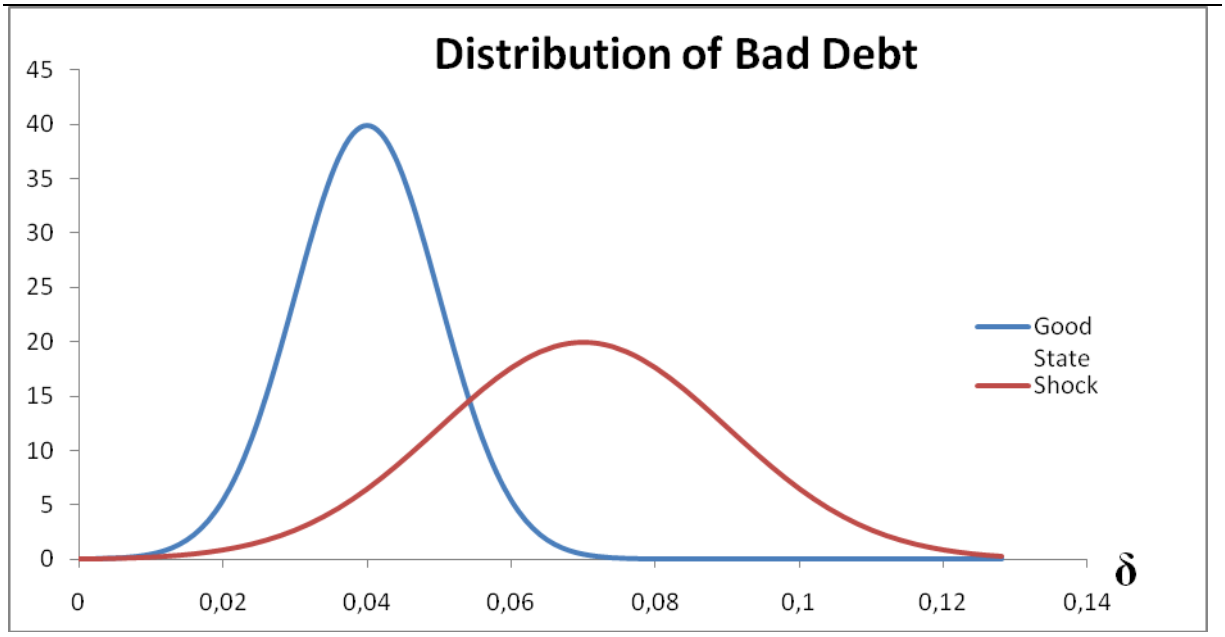
where S is the size of the cash needed $S = F - M_t + i.(1-\delta_t).L_{t-1}$, $\frac{dK}{dS} > 0$, $\frac{dK}{d\delta_t} > 0$ and K=0 when S=0. The cost of financial distress depends on the proportion of bad debt, δ, in two ways. First the size **S** of the cash needed is directly determined by the realized value of δ. Furthermore, the current value of δ is an indication of the expected values of the variable and thus determinant of the bank's risk. Other banks will buy part of its assets at a bigger discount or will demand higher premium on loans for high value of δ. Therefore the bank will choose some level of M_{t+1} that corresponds to some confidence level from the normal distribution (e.g. for 95% confidence level, Z =1.65 below). The bank, which exhibits some degree of risk aversion, will use a "conservative" estimate of proportion of bad debt (9) ,which is an equivalent explanation of the banking behavior to the MB=MC setting above:

$$\hat{\delta}_t = E(\delta_t) + Z.E(\sigma_t) \qquad \textbf{(9)}$$

$F = M^B_{t+1} + i_L.(1-(E(\delta_{t+1}) + Z.E(\sigma_{t+1}))L_{t+1}$ - risk adj. profit maximizing **(10)**

In a similar manner the bank will chooses its optimal confidence level in a way that it is too costly for it to decrease further the possibility of losses. From a practical point of view this is a typical tradeoff between risk and return. It is not without merit to assume that banks in reality are risk averse, at least to some extent. If they were risk neutral this would mean that they will be indifferent between giving one extremely big loan with 10% probability of default or many small loans each with 10% probability of default, everything else held constant.

Figure 5: Shock to the Level of Bad Debt



Example	Mean	Standard Deviation
Good State	0,04	0,01
Shock	0,07	0,02

Assume that during a good state of the world the average level of bad debt is 4% with a standard deviation of 1%. A bank which would like to avoid liquidity problems with 95% certainty during a given period will use a conservative estimate of its level - $\hat{\delta}_t = E(\delta_t) + Z.E(\sigma_t)$ *in this case -* $\hat{\delta}_t = 0,04 + 1,65.0,01 = 0,0565$ *At the same time if a shock to the financial system occurs and the mean level of bad debt increases to 7% with 2% standard deviation, the new conservative estimate will be* $\hat{\delta}_t = 0,07 + 1,65.0,02 = 0,103$

Then combining equations 7 and 10 the bank will lend an amount for new loans equal to:

$$L_{add(t)} = M_t^E - \delta_t.L_t - F + i_L.(1 - E(\delta_{t+1}) - Z.E(\sigma_{t+1}))L_{t+1} \qquad \textbf{(11)}$$

However, since $L_{t+1} = L_t + L_{add(t)}$ *we get:*

$$L_{add(t)} = \frac{M_t^E - \delta_t.L_t - F + i_L.(1 - E(\delta_{t+1}) - Z.E(\sigma_{t+1}))L_t}{[1 - i_L.(1 - E(\delta_{t+1}) - Z.E(\sigma_{t+1}))]} \qquad \textbf{(12)}$$

$$\frac{dL_{add(t)}}{dE(\delta_{t+1})} < 0, \quad \frac{dL_{add(t)}}{dE(\sigma_{t+1})} < 0, \quad \frac{dL_{add(t)}}{dM_t^E} > 0, \quad \frac{dL_{add(t)}}{d\delta_t} < 0, \quad \frac{dL_{add(t)}}{dF} < 0, \quad \frac{dL_{add(t)}}{di_L} > 0$$

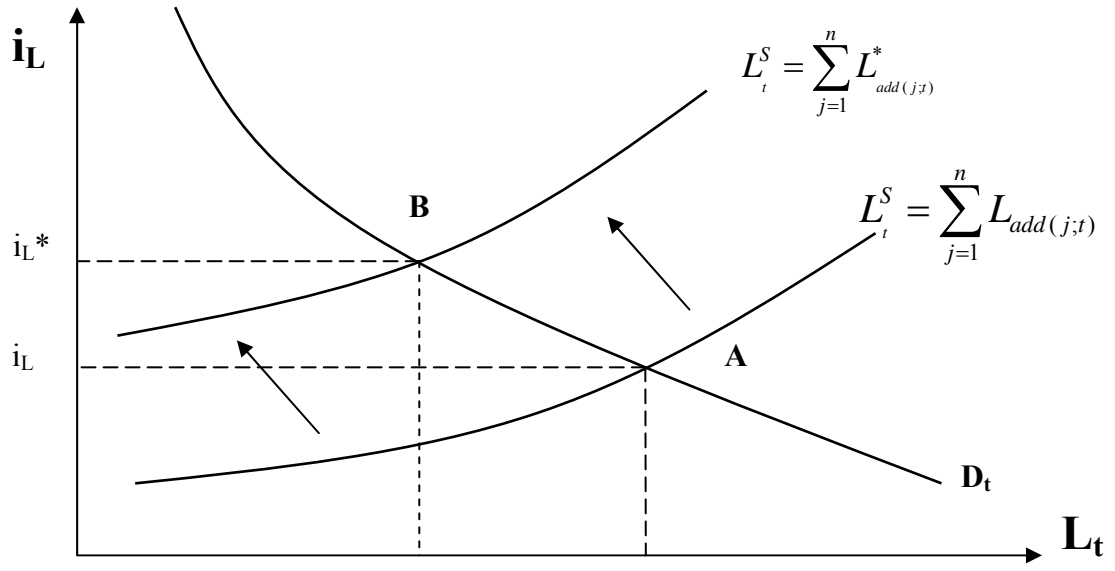
The amount of new loans at time t is increasing in the amount of money at the end of the period and the market interest rate, and decreasing in the current level of bad debt, the expected future level of bad debt, the uncertainty about the future level of bad debt and amount of fixed cash outflows/ costs that the bank has.

At any given time period **t** the aggregate supply of loans to the economy, L_t^S , will equal to the sum of all additional loans, $L_{add(j;t)}$, by all banks in the economy. As stated previously, due to the assumption of perfect competition in the financial industry, all banks can lend all of their free cash at the interest rate currently prevailing on the market and will choose to do so, after adjusting for the expected future risk. If there are **n** banks operating on the market, then the supply of new loans will equal **n** times the new loans supplied by the 'average' bank. Since all banks are atomistic and similar in all important aspects, they also hold the same expectations for the future level of risk. Thus, the only features, which can vary across banks, albeit not dramatically, are the current level of bad debt, the amount of liquid assets at the end of the period and the loans outstanding at time **t**. The total supply of new loans is given by:

$$L_t^S = \sum_{j=1}^{n} L_{add(j;t)} = n.\frac{\bar{M}_t^E - \bar{\delta}_t.\bar{L}_t - F + i_L.(1 - E(\delta_{t+1}) - Z.E(\sigma_{t+1}))\,\bar{L}_t}{[1 - i_L.(1 - E(\delta_{t+1}) - Z.E(\sigma_{t+1}))]} \qquad \textbf{(13)}$$

j={1, 2…n)

Figure 6: Aggregate Supply and Demand of Loans



Initially the economy is in equilibrium at point A, where the demand for loans by the companies equals the loans supplied by the banks, eq. 13. After that an exogenous shock to financial system occurs - $E(\delta^*_{t+1}) > E(\delta_{t+1})$ *and* $E(\sigma^*_{t+1}) > E(\sigma_{t+1})$. *Ceteris paribus, each bank will choose to grant less new loans and leave more money in reserves in expectation of worsening credit conditions. The new supply function becomes* $L^S_t = \sum_{j=1}^{n} L^*_{add(j,t)} = n.\frac{\bar{M}^E_t - \bar{\delta}_t.\bar{L}_t - F + i_L.(1 - E(\delta^*_{t+1}) - Z.E(\sigma^*_{t+1}))\bar{L}_t}{[1 - i_L.(1 - E(\delta^*_{t+1}) - Z.E(\sigma^*_{t+1}))]}$. *This causes the aggregate supply curve to shift upwards. The new equilibrium at point B is characterized by higher interest rates and lower level of loans.*

The main conclusion of the model so far is that banking credit can 'freeze' if there is a big enough external shock on the estimate of future risk - $E(\delta_t) + Z.E(\sigma_t)$. With a certain degree of safety, we can assume that during turbulent times both the expected future losses - $E(\delta_t)$, and the uncertainty about these losses - $E(\sigma_t)$, increase, thus inducing the given bank to build up additional reserves and cut back on new loans. Since all banks are atomistic, hold similar types of assets and follow the same decision making, the adverse shock will cause aggregate decline of loans supplied and increase in the interest rates in the economy, as demonstrated above. Although the increase in interest rates induces the banks to lend more, this effect will only dampen the shock, but will not be enough to offset it. On the graph above are plotted only the two equilibriums, net of the interest effect. It should be noted that in this situation, as the banks forego additional business due to the perceived high risk and uncertainty, the financial sector of the economy may in fact declines, which contributes to a potential recession.

The same outcome can be achieved even if **L** is not an illiquid asset but any asset with uncertain pay-off and falling price, that cannot be disposed off without additional cost and for which the bank has to make provisions against losses. Such were the mortgage backed securities during the financial crisis, although in theory there was a readily available market for them. In this case there was an additional liquidity spiral in the price of the assets that induced the bank to behave in conformity with the model above. Next, the model is further expanded by including investment decisions of firms to determine the effect of adverse shock on the expected risk on the aggregate output of the economy.

Let us assume that our simple economy under consideration is divided only into two sectors – the financial system, as described above, and manufacturing industry. The production sector is also perfectly competitive and is composed of numerous identical firms with no market power. In addition they produce the same identical product and can sell unlimited quantities of it at the current market price without any price impact. The companies also face the same investment opportunities and have the same decision making process with regard to them. Thus they will react in a similar manner to a change in the economic conditions. Each firm produces goods according to the following Cobb-Douglas production function, which transforms the two inputs – labor and capital into final product:

$$Q_t = f(L_t, K_t) = a_t L_t^{\alpha} . K_t^{\beta} \qquad \textbf{(14)}$$

*Where Q_t is the monetary value of the total production of a given firm at time **t**, a_t is the total factor productivity, which we assume to be constant in the short-run and equal for all firms in the economy. However it is increasing with time and ensures that companies will have profitable investment projects. L_t and K_t are respectively the stock of labor and capital available to the firm at time **t** in monetary terms. We also assume constant returns to scale, thus $\alpha + \beta = 1$. The marginal product of capital is diminishing due the decreasing profitability of the available investment opportunities.*

Also for the needs of the model we assume that there is a full employment in the economy and it is sticky at least in the short-run. Employers will be reluctant to fire employees at least initially in order to smooth out their stock of labor through the cycle. This gives us the opportunity to treat L_t^{α} as a constant and concentrate on the investment decisions in capital. Therefore the production function becomes:

$$Q_t = f(\bar{L}_t, K_t) = \overline{a_t . L_t^{\alpha}} . K_t^{\beta} \qquad \textbf{(15)}$$

That means that companies can control the production level for the next period by selecting a level for their capital stock K_t. The capital stock at period **t** equals the value of capital stock from the previous period, plus the investments in capital, minus the depreciation on the capital stock from the

$$K_t = K_{t-1} + K_{add} - D \qquad \textbf{(16)}$$

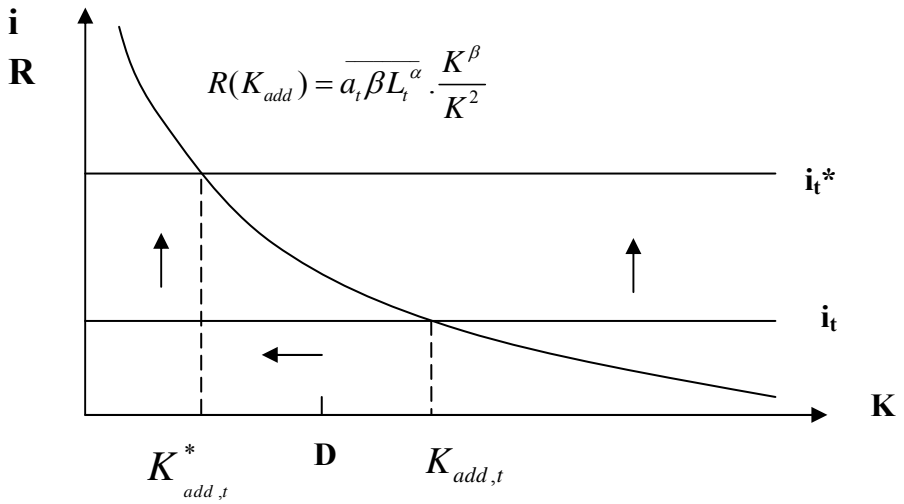
We assume that the depreciation that the firm faces, and in the economy as whole, is a constant fraction - η of the capital stock.

$$K_t = K_{t-1} + K_{add} - \eta K_{t-1} = (1-\eta)K_{t-1} + K_{add} \qquad \textbf{(17)}$$

Given that the change in output of a company from one period to the next depends only on its choice of capital stock, if it does not invest in new capital to a level at least equal to the depreciation its output will fall. Moreover, since all companies in the economy are identical, when there is an incentive to invest less in a given period than the aggregate output in this sector of the economy will decrease.

We assume that in order to invest in new capital, the firm needs to borrow at the current market interest rate – i. Therefore, it will invest in additional capital until the marginal product of capital will equal its cost - $\frac{dQ}{dK} = a\beta L^{\alpha} K^{\beta-1} = iK$. In order words, in equilibrium the marginal return on capital is equal to the interest rate $R(K_{add}) = \overline{a_t \beta L_t^{\alpha}} . \frac{K^{\beta}}{K^2} = i$. Due to technological progress – **a,** MPK will increase in time and in every period the companies will have some profitable investment opportunities. However, an adverse shock to the interest rates will induce the company to invest less than it would have done otherwise. Thus, $\mathbf{K_{add}}$ is a function of the interest rate - $K_{add} = f(i)$ and it is decreasing in i.

Figure 7: Interest Rate Shock to the Economy



*At time **t** every company in the economy will find it profitable to expand its capital stock until the return on the marginal unit of capital is equal to the interest rate - i_t . At this point K_{add} is bigger than the depreciation on K_{t-1} and the manufacturing sector of the economy expands. After that an adverse shock to the financial sector causes the banks to abruptly decrease lending. As a result the interest rates at which the firms can borrow increases and the horizontal line shifts upward. The new, higher interest rate now is i_t^*. Consequently the cost of capital increases and many previously profitable projects become unattractive. The companies will now invest in additional capital only to the point $K^*_{add,t}$, which is not enough to cover the deprecation on capital from previous periods. Thus all companies will produce less than they had produced in the previous period t-1.*

Since our small economy consist of two sectors only – the banking system and the manufacturing industry, then the GDP of the economy is just a combination of the aggregate production in them. The output of the production firms is straightforward and the output of financial systems is the amount of new loans lent. If there are N banks and M production firms, the GDP at period **t** is - $Y_t = \sum_{i=1}^{m} Q_{j,t} + \sum_{j=1}^{n} L_{add(j,t)}$ or in more details:

$$Y_t = m.a_t L_t^{\alpha}((1-\eta)K_{t-1} + K_{add})^{\beta} + n.\frac{\bar{M}_t^E - \bar{\delta}_t.\bar{L}_t - F + i_L.(1 - E(\delta_{t+1}) - Z.E(\sigma_{t+1}))\bar{L}_t}{[1 - i_L.(1 - E(\delta_{t+1}) - Z.E(\sigma_{t+1}))]}$$

The change in percentage change in GDP will be $\frac{\Delta Y_{t-1,t}}{Y_{t-1}} = \frac{(m.\overline{Q_t} + n.\overline{L_{add,t}})}{m.\overline{Q_{t-1}} + n.\overline{L_{add,t-1}}} - 1$ where the output of the banks is a function of the perceived risk and the output of the companies is function of the interest rates. If there is an unfavorable shock to the expected future risk or losses in the financial sector, the banks will respond by tightening credit. This will directly decrease the output in this sector of the economy. Consequently the market interest rate will increase, which will make some investment opportunities no longer profitable. The production companies will follow by investing less and thus producing less. As a result, if the shock is big enough, the whole economy will enter into a recession. This demonstrates that the expectations of the banks about the future of the economy can be strongly procyclical. The next section will attempt to test some of the features of this model empirically.

5. Econometric Model of Spillover effect in Europe due to adverse developments in the financial institutions in USA

The second goal of this paper is to develop a model of the adverse shock that the US subprime financial crisis had on the European financial system, and mainly to evaluate the consequences for the real European economy. While in the United States the severe recession was a result of the mutually enhancing effects of the decline of the housing prices and the financial crisis, during 2007 the European economy was performing relatively well. This gives us the opportunity to isolate to a certain extent the role of banks on the 2007/2009 financial crisis at least in Europe. In a broader sense it is related to the theoretical model from the previous section. If we depart from the simplification of δ as a proportion of the bad debt, but take it as any expected, stochastic losses from operations, then the variables explained below may measure the shock to δ. In particular the variables **EuroSpread**, **Loans**, **IntSpread** and **Survey** should partially capture both the increasing E(δ) and the increasing uncertainty about those losses - σ.

The model uses data from the United Kingdom, Norway, Sweden, Switzerland and the Euro Area countries, without Cyprus, Malta and Luxembourg, to perform a panel regression with fixed effects of the quarterly change in GDP on several variables that should capture the impact of banks on the overall economy. Cyprus is not included in the analysis since it joined the Eurozone only in 2008 and its economy is heavily dependent on tourism with relatively small manufacturing sector, combined with some specific political issues. Malta's economy is also very dependent of tourism and Luxembourg has very big financial sector, relative to the rest of the economy. Therefore including those countries may bias the results. The other European countries outside the euro area are also not included because their banking sectors are dominated by large banks from the Eurozone that either bought smaller local banks or established branches. They tend to have relatively simpler banking operations and in general did not hold any of the toxic assets that caused the first wave of the financial crisis. Nevertheless the banks in those countries had the same undesirable effect, especially on the booming economies in Eastern and South-Eastern Europe, but under different conditions. Therefore an assessment of the role of banks in the recession in these countries should be performed separately and is a good topic for a further research.

The model uses quarterly observations of GDP for 17 countries from 2000 to the end of 2009. For a robustness test, the same regression is performed only for the periods 2000 – 2006

(benchmark Normal Period) and 2007 to the end of 2009 (Financial Crisis), total of 680/440/204 observations (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Slovakia, Slovenia, Spain, United Kingdom, Switzerland, Sweden and Norway). The model implicitly assumes that the deteriorating environment in the European banking system after 2007 is result of the spillover effect of the US financial crisis, which is tested in the extensions of the model. It is expected that during 2007-2009 the coefficients on the variables will be different or more significant compared to the results for the Normal Period.

The Baseline Model:

$$\Delta GDP_t = f(EuroSpread_t, Capital_t, Loans_t, IntSpread, CurrAcc_t, Survey_t)$$

There are both banking specific and macroeconomic variables.

EuroSpread: this is the spread between the 1 year and 1 week Euribor rates minus the ECB target interest rate from one quarter to the next. Equivalent calculation is used for the countries outside the euro area. An average of daily observations of the rates during the quarter is used. This is a proxy of the overall condition on the interbank market. When the level of EuroSpread is high, the cost of bank resources is high and it might be the case that banks are reluctant to lend to each other. It also potentially captures the increase of uncertainty about the future economic development. The predicted sign of the variable on the dependent variable, GDP, is negative. Since the European banking market is integrated, EuroSpread should affect all countries in a similar way. Euribor rates and other macroeconomic data used are taken mainly from the website of the European Central Bank.

Profit: Is the percentage change of earnings of a given country's banking system from one period to the next. The data is taken from the database of the OECD Countries. This is a proxy attempting to capture the relative amount of subprime-related assets and other toxic assets that European banks held. Since the European economy was in a good condition prior to the financial crisis, it is not unreasonable to assume that banking losses are mostly related to the global financial crisis during the period 2007-2009. It also captures the increase (or decrease) in provisions for future losses that the banks made during the period or in general during recessions. Losses and provision should directly impact the lending behavior of the banks, forcing them to increase the margin on loans and thus may have a causal impact on the rest of the economy. The predicted sign of the variable on the dependent variable is positive.

Since data is not available on shorter time periods than one year, a separate regression has to be performed only for this variable and year-on-year change in GDP. This will be done in the extensions to the model.

Loans: This is a straightforward variable defined as the percentage change of loans to non-financial companies from the balance sheets of the banks from one quarter to the next. Percentage change is used instead of absolute change so that we can control for the size of the economy. The interpretation of the variable is also simple – a decrease in the supply of new loans will directly impact investing decisions of the companies. However, a possible obstruction of the predicting power of the variable is the idea frequently cited by bankers that during a recession lending decreases because of the lack of new profitable projects. Nevertheless, this should not be the case in Europe for the given period since we expect that the decrease in lending preceded the recession. The expected sign of the variable is positive. This variable will be estimated both on country specific basis and for the European Union as a whole. The rationale behind this is that the European economy is so integrated that the aggregate value may have a higher predicting power than the country specific as companies can borrow from foreign banks and domestic banks can lend to foreign corporations.

Capital: This variable is defined as the weighted average of total equity plus subordinated debt over total liabilities of the banks in a given country at the end of the period. Data is calculated from the aggregate balance sheet of the financial sector in the country under scrutiny and reported by the ECB. The variable is a proxy for the risk in the banking system in a given country. It will also be estimated both on a country specific and aggregate basis for the same reasons mentioned before. The notion behind this variable is that the less Tier 1 capital present in the banking system before the crisis, the more risky and susceptible to shocks it is. Thus, countries where banks were inherently more risky possibly suffered a more severe downturn during the crisis. Therefore, for the country-specific variable we have to use the level of **Capital**. In contrast, the change in the aggregate value from quarter to quarter can tell us more about the developments in the banking system as a whole. Its sign, however, is somewhat ambiguous. During good times and in the absence of financial shock, more levered banks should have affected the economy positively, while in the presence of a shock, and in the state of increasing risk, those same banks should have a more negative impact than similar less levered banks. Therefore, it is possible that the variable will have different signs during the normal period and the crisis.

IntSpread: is the spread between the interest on loans offered by the banks and the interest on deposits. It should proxy for the expected level of bad debt and other anticipated future losses supplementary to the provisions in the balance sheets, which are dependent on accounting practices and regulatory definitions and thus are not entirely reliable. It can be viewed as the cost of financial intermediation, which rises under uncertainty increasing shocks. The expected sign on the variable is negative – the higher the spread, the higher is the negative impact on the economy.

CurrAcc: This variable is defined as the change of current account balance as a % of GDP of a given country from one quarter to the next. It is attempting to capture the effect of external, non-financial system related deterioration of economic conditions that have a causal impact on GDP. It is potentially important for exporting countries like Germany, that suffered when demand for their locally produced goods and services from abroad declined sharply during the global downturn. Since in many places the recession preceded the slump in the European economies, it can be expected that the change of the current account balance also had a significant causal effect on GDP. With this variable we acknowledge that there were other factors, besides the troubles in the financial system, which are responsible for the decline in the real economy in Europe. It can be expected that in general an increase in the current account surplus/deficit will have positive/negative impact on GDP.

Survey: This is the overall weighted average response to Question 6 of the Euro Area Bank Lending Survey "Please indicate how you expect your bank's credit standards as applied to the approval of loans or credit lines to enterprises to change over the next three months." "Easing" is given a positive weight over 3, unchanged is given a weight of 3 and "tightening" is given a weight below 3. Survey below 3 is assumed to have a negative impact on GDP during the following quarter. The bank lending survey is published in the beginning of every quarter.

In order to assess the robustness of the model, the same regression will be run with lag in the variables t-n, where $n \in (1,2)$. The expectation here is that as we go further into the past, the effect of the variables on the aggregate output should fade off.

$$\Delta GDP_t = f(EuroSpread_{t-n}, Capital_{t-n}, Loans_{t-n}, IntSpread, CurrAcc_{t-n}, Survey_{t-n})$$

Additionally, in the place of ΔGDP, two other alternative proxies, change in industrial production and the level of unemployment, will be used to judge the effect of those variables on the real economy. The hypothesis is that unemployment should be to some extent lagging and sticky, while the effect on the industrial production should be more immediate.

In the empirical section of the paper, the baseline model will be complemented with several extensions to improve the quality of the results. The first addition will be a vector autoregressive model attempting to capture the evolution and interdependencies between the multiple time series. It may be the case that the economic relationships between the variables are much more complicated than the abovementioned theory predicts which can have implications for the value of the final outcome. Here a Granger causality test on the two different time periods will be helpful in determining, whether the regression reflects just correlations or there is indeed some causal relationship between the variables and GDP. A natural expansion of the VAR is an impulse response function to describe how the economy reacts overtime to exogenous shocks on each of the abovementioned variables. This will help us answer the question whether these shocks have just temporary or long-term impact for the aggregate output.

The data for the macroeconomic variables is readily obtained from the ECB's and Eurostat's websites, where quarterly, seasonally indexed GDP and interest rates are available. Data on current account deficits and surpluses is obtained from OECD Countries database. The data about the bank specific variables related to their balance sheets is also easily found on ECB's statistics section. For the countries outside the Eurozone, the same data can be downloaded from the statistics section of their corresponding central banks. For our purposes it is sufficient to use the aggregated balance sheet of the financial institutions for each of the countries, which is calculated on a monthly basis. Even though this statistic includes some non-bank financial institutions, it should still be a good approximation for the role of banks, since they control the bigger part of the market. The same statistics for the United Kingdom can be obtained from the website of the Bank of England. The **Profit** variable is estimated from the aggregate income statement of the banking sector of each country at the end of the year and reported by OECD database. Although many banks operate in several countries, their losses related to the financial crisis are typically incurred by their main headquarters and the overall impact on the real economy is the strongest at that location. Results will be presented into several steps, while gradually adding more variables.

6. Results and Empirical Findings

The idea for the for the **EuroSpread** variable is taken from Kao and Shumaker (1999) where the authors use yield spread between 10-year T-bonds and 3-month T-bill to time the equity market on the premise that this spread is potentially indicative of future recession. Although they find that this is the most promising variable to time the market, their results are still too volatile to predict actual recessions. Therefore, for the purposes of this paper the yield spread is substituted with the spread between 1 week and 12 months Euribor, which should capture both the general expectations about the future of the economy and the assessment of the banks about the level of risk in the financial system. Of course measuring the shocks to risk is one of the main goals here. In addition, it may indicate better the underlying processes of the economy, because it reflects uncollateralized borrowing and is not affected by the flight to quality and the safety of government debt. The spread is further normalized by dividing it by official short term target rate of the central banks.

As mentioned before, Beltratti and Stultz (2009) find that during the financial crisis banks with more Tier 1 capital performed relatively better in terms of stock returns and profitability. Moreover Holmsotrm and Tirole (1997) claim that during previous financial crises, like in Scandinavia during 1980-1990, the equity value of the banking system significantly affected lending. Therefore the variable **Capital,** which is basically the Tier 1 ratio, is used to test whether countries with banks that had more capital also performed better during the crisis. The level of integration of the European economies gives reasons to believe that the change of total capital of the banking system may be important not only on a country level but also as an aggregate value.

The variable that measures the interest spread between the deposits and the loans to non-financial corporation, **IntSpread**, is directly borrowed from Edwards and Vegh (1997), who show that during the earlier financial crises in emerging economies, banks have increased this spread to account for the higher risk of lending and this have had a further negative impact on the overall economy. A small problem with **IntSpread** is that data about it is available from ECB only since 2003, which gives more weight to the crisis years in the regressions. The same problem is in place with the **Survey** variable. To control for this issue, the first 3 tables below report the same period results only for the variables for which data is available since the year 2000, excluding **IntSpread** and **Survey**. "**Eur**" is indication of aggregate variable and "**Domestic"** for country specific.

Table I

GDP Growth Rate and Aggregate Variables: Q1 2000 – Q4 2009

Quarter on quarter, seasonally adjusted GDP growth rate, from 2000Q1 to 2009Q4, is regressed using panel data of 18 countries plus the Eurozone as whole. GDP data is from Eurostat. **EuroSpread**, **Capital** and **Loans** data is from the statistical warehouse of ECB, while **CurrAcc** data is taken from statistical section of the OECD countries website. Initially only the aggregate values of Loans and Capital are used (For EU as whole), and **IntSpread** and **Survey** are dropped all together, as this regression allows for the biggest number of observations - 760. Reported underneath are the mean and standard deviation for each of the variables, the coefficient on the independent variables, as estimated by the regression, the t-statistics and the p-value at which the variable becomes significant, as well as the resultant constant term (intercept).

Panel A: Descriptive Statistics

	GDP	EuroSpread	Capital_Eur	Loans_Eur	CurrAcc
Mean	0.4492105	0.3859676	0.0172118	1.668528	0.0198384
St. Dev.	1.093157	0.8717334	0.0748084	1.388806	1.799318

Panel B: Regression Results:

Fixed-effects (within) regression — Number of obs = 760

Group variable: countryid — Number of groups = 19

R-sq: within = 0.0959 — Obs per group: avg = 40.0

Variable	Coefficient	St. Error	t	P-value	95% Confidence	
GDP Growth Rate						
EuroSpread	-0.2591057	0.0564407	-4.59	0.000	-0.3699094	-0.1483021
Capital_Eur	2.095831	0.6123492	3.42	0.001	0.8936748	3.297988
Loans_Eur	0.1622423	0.0311577	5.21	0.000	0.1010738	0.2234108
CurrAcc	0.0344875	0.0208145	1.66	0.098	-0.0063752	0.0753502
Intercept	0.241754	0.073629	3.28	0.001	0.0972065	0.3863014

Table II

GDP Growth Rate and Domestic Variables: Q1 2000 – Q4 2009

The same panel data regression, with fixed effects for the countries is performed again but only with domestic values for **Loans** and **Capital**. Data used is from 2000Q1 to 2009Q4. The number of groups decreases to 17, as the combined data for the Eurozone is dropped and there is no data on the capital of Swiss banks. There are also observations missing for Slovenia and Slovakia until their admission to the EU, respectively 2004Q1 and 2006Q1. Once again the variables **IntSpread** and **Survey** are not explored for the time being as they further decrease the total number of observations. The domestic values for **Loans** and **Capital** are taken the statistical warehouse of the European Central Bank and from the respective central banks of the countries outside the eurozone.

Panel A: Descriptive Statistics

	GDP	EuroSpread	Capital_Domestic	Loans_Domestic	CurrAcc
Mean	0.4492105	0.3859676	7.309649	2.452264	0.0198384
St. Dev.	1.093157	0.8717334	2.45177	13.75123	1.799318

Panel B: Regression Results:

Fixed-effects (within) regression — Number of obs = 638
Group variable: countryid — Number of groups = 17
R-sq: within = 0.0844 — Obs per group: avg = 37.5

Variable	Coefficient	St. Error	t	P-value	95% Confidence	
GDP Growth Rate						
EuroSpread	-0.3097282	0.0488738	-6.34	0.000	-0.4057073	-0.2137491
Capital_Domestic	0.1677674	0.0469269	3.58	0.000	0.0756115	0.2599232
Loans_Domestic	0.0077512	0.0030793	2.52	0.012	0.001704	0.0137985
CurrAcc	0.0409455	0.0267823	1.53	0.127	-0.01165	0.0935411
Intercept	-0.7183271	0.3509548	-2.05	0.041	-1.407538	-0.0291163

Table III

GDP Growth Rate, Aggregate and Domestic Variables: Q1 2000 – Q4 2009

Underneath are the results from panel data regression with fixed effect for the countries, using both aggregate and country-specific independent variables for **Loans** and **Capital**. The number of observations is the same as in the previous case, as they are limited by the country-specific data. The other variables of the model - **IntSpread** and **Survey** are still not explored in this step in order to maximize the number of observations for the case under scrutiny.

Panel A: Descriptive Statistics

	GDP	EuroSpread	Capital_Dom	Capital_Eur	Loans_Dom	Loans_Eur	CurrAcc
Mean	0.4492105	0.3859676	7.309649	.0172118	2.452264	1.668528	.0198384
St. Dev.	1.093157	0.8717334	2.45177	.0748084	13.75123	1.388806	1.799318

Panel B: Regression Results:

Fixed-effects (within) regression — Number of obs = 638
Group variable: countryid — Number of groups = 17
R-sq: within = 0.1265 — Obs per group: avg = 37.5

Variable	Coefficient	St. Error	t	P-value	95% Confidence	
GDP Growth Rate						
EuroSpread	-0.2872094	0.0643131	-4.47	0.000	-0.4135093	-0.1609095
Capital_Domestic	0.168304	0.0459505	3.66	0.000	0.078065	0.2585429
Capital_Eur	2.326558	0.6984203	3.33	0.001	0.9549803	3.698136
Loans_Domestic	0.0072944	0.0030241	2.41	0.016	0.0013556	0.0132332
Loans_Eur	0.1684677	0.0358157	4.70	0.000	0.0981318	0.2388037
CurrAcc	0.0441705	0.0262206	1.68	0.093	-0.0073222	0.0956632
Intercept	-1.056101	0.3526835	-2.99	0.003	-1.748711	-0.3634912

First of all, the reason to regress GDP growth rate on the same period banking specific and macroeconomic variables, rather that employing some lag, is that the financial system is big enough and decline in its activities will have an immediate impact on GDP. The same is true for the current account surplus or deficit, since the trade balance enters directly into the calculation of aggregate output. Moreover, it can be expected that when the non-financial companies take a loan from the financial intermediaries, they will tend to utilize it within the same quarter, which will also affect GDP growth in the period. Change in lending will also certainly impact future periods through higher production and investments. Thus the situation with lags in the variables is examined in Section 6.1.

First we see that all of the variables appear to be very significant, but the Rs-squared are relatively low, reaching only 0,13 in the combined regression in Table III. The encouraging result is that **EuroSpread**, which is at the basis of the theory about the procyclical effect of risk in the financial system, is also significant at 0.1% in the three cases. Moreover, the coefficient of the regression has the expected negative sign and remains relatively stable in the boundaries between -0,25 and -0,3 with a very low standard error around 0,06. The coefficient on the variable seems small compared to the other coefficients, but this is because the **EuroSpread** is very sensitive to small changes. This is because its mean value is only 0,386 which indicates that on average the spread between the long and short interbank offered rates is only 0,386 times the short term target rate of the central bank.

The coefficients on the aggregate and country specific values of **Capital** are also significant and have the expected sings. This supports the extension to the theory of Beltratti and Stultz (2009) that countries with better capitalized banks were less affected by the financial crisis and that in general the increase of capital of the financial institutions is related positively to economic growth. The domestic variable is more volatile than the aggregate, because the later is heavily influenced by the level of capital in the countries with big banking sectors. This is evidence of the notion that the aggregate variable is perhaps more indicative of the underlying processes in the financial system in Europe that are more complex than the predictions of the model. In any case this is the reason why the coefficient on the country specific capital is lower than the one on the aggregate.

As expected, the current account is significant at 10% for the entire period 2000-2009, and the coefficient is strictly positive. We see that on average the European countries were increasing

their surplus with 0,02% but the standard deviation is quite high 1,7%. However the situation with the **Loans** variable is not so straightforward. We see that the aggregate value of the loans is statistically and economically significant in both regression and the coefficient is positive. However the domestic variable is significant only at 5% and the small coefficient makes it economically insignificant. Once again the reason is the high volatility of the variable. This should not be the case, because the variable is calculated from the outstanding amounts of loans at the end of each period. On the contrary, there are periods in which the domestic loans increase or decrease by more than 10%, especially for the smaller countries in Europe, while the average values of the two variables are similar. The only explanation of this phenomenon is that the financial institutions that operate in more than one country simultaneously shift loans between the different branches.

In table IV below are reported the results of the full regression of the model constructed in the previous section. The regression is performed on the period 2003-2009 and the total number of observations drops by almost 200 which certainly has an effect on the results. The first thing to notice is that by including two additional variables and shorting the time period the R-Squared increases to 0,37. The main variables **EuroSpread**, **Capital_Eur** and **Loans_Eur** keep their high significance level and their coefficients are little affected. The first surprise is that the current account has become statistically insignificant, because its coefficient has decreased by 50% while the standard error has remained almost the same. The same is true for domestic value of capital, which is only marginally insignificant at 10%.

The real surprise comes from the variable that accounts for the interest spread between loans and deposits. It is significant at 0,1% but the sign of the coefficient is positive instead of the expected negative. This means that the spread between the two becomes lower in times when we would expect a higher risk premium to be calculated in it. This is contrary to the observations of Edwards and Vegh (1997) about various financial crises around the world and the effect of interest rates in them. It appears that financial institutions act more like other types of firms and lower their margins during bad times. A possible explanation for this discrepancy will be address in section 6.1 after the appropriate robustness tests are performed. The results for the **Survey** variable also provide an interesting result. It seems that the expectations of the banking managers about the lending standard during the following quarter are strongly, positively correlated with economic activity. This directly supports the proposition of the theoretical model that expectations have causal impact on the actual events.

Table IV

Full Model Regression: Q1 2003 – Q4 2009

Below are presented the results from the regression of the complete econometric model as described in first subsection. Data for **Survey** and **IntSpread** variables is available only since the beginning of 2003 which significantly decreases the sample size and gives relatively more weight to the financial crisis years compared to the previous results. Data for **Survey** and **IntSpread** is obtained from ECB.

Panel A: Descriptive Statistics

	GDP	EuroSpread	Capital_Dom	Capital_Eur	Loans_Dom	Loans_Eur	CurrAcc	Survey	IntSpread
Mean	0.4492105	0.3859676	7.309649	.0172118	2.452264	1.668528	.0198384	2.8375	0.2133676
St. Dev.	1.093157	0.8717334	2.45177	.0748084	13.75123	1.388806	1.799318	1.872147	.7203116

Panel B: Regression Results:

Fixed-effects (within) regression — Number of obs = 455

Group variable: countryid — Number of groups = 17

R-sq: within = 0.3689 — Obs per group: avg = 26.8

Variable	Coefficient	St. Error	t	P-value	95% Confidence	
GDP Growth Rate						
EuroSpread	-0.1392332	0.0811168	-1.72	0.087	-0.2986679	0.0202016
Capital_Domestic	0.0998923	0.0561576	1.78	0.076	-0.0104852	0.2102699
Capital_Eur	1.715533	0.7734312	2.22	0.027	0.1953566	3.235709
Loans_Domestic	0.0098558	0.0032503	3.03	0.003	0.0034674	0.0162442
Loans_Eur	0.1805128	0.0494368	3.65	0.000	0.0833451	0.2776806
CurrAcc	0.0184992	0.0295721	0.63	0.532	-0.0396247	0.0766231
IntSpread	0.8554676	0.1531859	5.58	0.000	0.5543813	1.156554
Survey	2.206437	0.2509015	8.79	0.000	1.713292	2.699583
Intercept	-8.478176	0.71553	-11.85	0.000	-9.884547	-7.071804

6.1. Robustness Tests:

Tables V and VI below report the results of the same regression performed on the two different periods that are somewhat subjectively called here - "Normal Period" (2000 – 2006) and "Financial Crisis" (2007-2009). We see that during the benchmark, normal period the statistical significance of the **EuroSpread** variable, which measures risk in the financial system, has decreased dramatically. This is not surprising, especially when taking into account that its mean value has dropped to 0,11. As a whole the predictive powers of the banking specific variables have declined, which is also seen in the almost negligible R-squared (0,09). Despite this fact the coefficient on the aggregate value of loans is still significant at 1%. The domestic value of capital is only marginally insignificant at 10%. This means that well capitalized banks and the new loans to businesses are still important for economic growth. The same is true for the current account and the expectations of the bankers about the lending standards. So far, all coefficients show consistency in the observed signs.

On the other hand, the results from the regression on the financial crisis period strongly support the theory of procyclical effects of the banks during the crisis. This is despite the fact that the small number of available observations may affect the quality of the results. We see that the mean of the **EuroSpread** has increased to 1,0 and it coefficient decreased a bit to negative 0,4 while remaining significant at levels even below 1%. An increase in the perceived risk in the economy is indeed negatively correlated with economic growth. At the same time the coefficient on the current account has become insignificant, which indicates that the deterioration of the economic conditions in Europe did not happen through the standard channels of trade or at least that the effect of trade is not comparable in size to the financial crisis. The coefficient on the aggregate value of loans in Europe also shows notable robustness in all periods, supporting the suggestion of the theoretical model that the financial crisis was transformed into a recession through the bank lending channel. At the same time the country specific variable is insignificant only at 5%, which is probably due to the small sample size and the reasons pointed out above. The transmission mechanism will be further examined in section 6.2.

Another particularly positive results for the theoretical model is that the coefficient on the **Survey** variable has become both larger and more significant (at a level below 0,1%.) during the financial crisis period. As a comparison, during the benchmark period it is significant only at 2%. Considering that it measures the views of the banking managers on lending, we can

conclude that either their views became more consistent with economic developments (they became better at predicting) or that banks came to play increasingly bigger role in these developments through decrease in lending. The average value of **Survey** is also smaller, indicating contraction in lending. As a matter of fact this variable is the most consistently robust one in all tests, so the second explanation may indeed have more merit. The results from section 6.1 underneath also indicate that **Survey** does not only measure implicitly the perception of lending risk, but has actual implications for the level of new loans to businesses.

We also see that during the financial crisis the coefficient on the **IntSpread** is very significant as well, albeit with positive sign contrary to the initial expectations. It appears that there is another reason for the development of the spread. The interest rate on loans to non-financial corporations did in fact increase during the financial crisis, indicating higher risk in economy and higher default probabilities, but the interest rate on deposits increased relatively faster. The most credible explanation for this phenomenon is that when the financial system was hit by the interbanking credit crunch, the institutions had to turn to more traditional sources of capital like attracting deposits, instead of wholesale funding. For the banks, finding liquidity became more highly prioritized issue that their long term solvency and the spread even becomes negative for a short time in several countries. Moreover, they could control the solvency problems in the short-term by cutting back on lending, while the conditions were unfavorable. Further support for this hypothesis gives the fact that the spread in almost all European countries increased in last quarters of 2009 after the European central bank intervened on the market by supplying liquidity. At the same time the duration of the period is probably too small to account for the long term effects of the higher interest rates on loans.

Also as expected, during the financial crisis period the aggregate value of capital in the European financial system became more positively related to GDP growth rate, in comparison to the normal years. This means that in quarters when the banks had more capital, the decline/ growth of the economy was smaller/ bigger. However, this observation can be related either to banking losses or to attracting new capital, and perhaps even to combination of the two effects. In any case the drop in Tier1 during the crisis is much smaller than the increase in the later quarters of 2009, giving some support to the later. In any case, the more volatile, country specific capital is surprisingly insignificant in both periods. Therefore, at the end there are no definite evidence that countries with better capitalized financial system were less impacted by the crisis. More research is needed in this direction.

Table V

Full Model Regression – Normal Period: Q1 2003 – Q4 2006

Panel A: Descriptive Statistics

	GDP	EuroSpread	Capital_Dom	Capital_Eur	Loans_Dom	Loans_Eur	CurrAcc	Survey	IntSpread
Mean	0.6727444	0.1129378	7.341517	0.0050264	1.772951	1.649538	0.0200763	2.908125	2.089355
St. Dev.	0.7427678	0.1874303	2.452239	0.0533335	10.76097	1.128518	1.692039	0.1592519	0.700423

Panel B: Regression Results:

Fixed-effects (within) regression — Number of obs = 251
Group variable: countryid — Number of groups = 17
R-sq: within 0.0876 — Obs per group: avg = 14.8

Variable	Coefficient	St. Error	t	P-value	95% Confidence	
GDP Growth Rate						
EuroSpread	-0.2330393	0.2859331	-0.82	0.416	-0.7964751	0.3303965
Capital_Domestic	0.1305982	0.0825765	1.58	0.115	-0.0321201	0.2933165
Capital_Eur	-0.4948541	0.9082831	-0.54	0.586	-2.284641	1.294932
Loans_Domestic	0.0024366	0.0044125	0.55	0.581	-0.0062584	0.0111316
Loans_Eur	0.1728021	0.0620278	2.79	0.006	0.0505754	0.2950288
CurrAcc	0.0536112	0.0295329	1.82	0.071	-0.0045839	0.1118062
IntSpread	0.3477161	0.2662431	1.31	0.193	-0.1769203	0.8723525
Survey	0.8774145	0.373323	2.35	0.020	0.1417929	1.613036
Intercept	-2.89724	1.663759	-1.74	0.083	-6.175704	0.3812249

Table VI

Full Model Regression – Financial Crisis: Q1 2007 – Q4 2009

Panel A: Descriptive Statistics

	GDP	EuroSpread	Capital_Dom	Capital_Eur	Loans_Dom	Loans_Eur	CurrAcc	Survey	IntSpread
Mean	-0.0723684	1.023037	7.241191	0.0456446	3.930399	1.712837	0.0192831	2.743333	1.575083
St. Dev.	1.521412	1.369798	2.455052	0.1043939	18.61891	1.862036	2.031737	0.2388636	0.6376338

Panel B: Regression Results:

Fixed-effects (within) regression — Number of obs = 204
Group variable: countryid — Number of groups = 17
R-sq: within = 0.4314 — Obs per group: avg = 12.0

Variable	Coefficient	St. Error	t	P-value	95% Confidence	
GDP Growth Rate						
EuroSpread	-0.3989795	0.100373	-3.97	0.000	-0.5970385	-0.2009204
Capital_Domestic	-0.0691005	0.1252484	-0.55	0.582	-0.3162539	0.178053
Capital_Eur	4.457842	1.284516	3.47	0.001	1.923099	6.992584
Loans_Domestic	0.0091679	0.0047439	1.93	0.055	-0.0001933	0.0185291
Loans_Eur	0.4914043	0.1152842	4.26	0.000	0.2639135	0.7188952
CurrAcc	-0.0238236	0.0513446	-0.46	0.643	-0.1251422	0.077495
IntSpread	0.730194	0.2885184	2.53	0.012	0.1608592	1.299529
Survey	2.313093	0.4515118	5.12	0.000	1.422122	3.204064
Intercept	-8.300836	1.241395	-6.69	0.000	-10.75049	-5.851184

In tables VII and VIII below are presented the result of the regressions with one and two period lags in the variables. As stated previously the banking variables should also have a longer term effects, beyond the same quarter. The initial expectations are that these effects will have identical sign as in the same period regression, but with size of the coefficients decaying in time. We see that this is exactly the case for **EuroSpread**, which is significant at 5% but its coefficient is only -0,15, compared to –0,29 for the same quarter in table III. However, the variable becomes insignificant with lag of two periods. Another positive signal is that the R-squared of the 1L regression is still 0,35 and 0,26 for the 2L. This means that the decrease in the explanatory power of the variables with 1 period lag is relatively small.

The same is the situation with the other two variables that were previously found to have the consistently strong correlation to aggregate output – **Capital_Eur** and **Survey**. The capital in the euro area financial system is positively related to economic growth with both one and two periods lag at a high significance level. This potentially answers the question about the actual effect of capital from above. It does not merely reflect the exogenous developments, like unexpected losses, but it is actually a precondition of for these developments. Its coefficient is very little changed from the results in table 3 indicating stable, long-term relationship. In addition, the domestic value of the capital is even more significant, further supporting the theory that capitalized banks are precondition for growth. The coefficient on the **Survey** variable is also significant with 1 and 2 periods lag, and slightly decreasing with time. Thus, it is the variable the most closely matches the initial expectations. Moreover, it gives robust evidence that the views that managers hold on the economy have causal impact on it, not only in the following quarter, but with certain long-term impact as well. Therefore, if the banks are worried about the future outlook of the economy, they will tighten lending standards in anticipation, which will have an actual negative causal impact on the future.

The full model regression has also been performed with two other dependent variables – unemployment and total industrial production. The results are found in Appendix III. The unemployment is correlated with **Loans_Eur, CurrAcc** and **Survey**, but many of the significant variables with 1 period lag have the opposite of the expected signs. On the other hand the industrial production behaves almost exactly as the GDP growth rate and is well correlated to **Capital**, **Loans_Eur**, Survey and **CurrAcc**, both in the same period and with lag. The next subsections will explore different sides of the transmission mechanism from shock to the perceived risk in the economy to decline in economic activity.

Table VII

Full Model Regression : Q2 2003 – Q4 2009 **1 Period Lag**

Panel A: Descriptive Statistics

	GDP	EuroSpread	Capital_Dom	Capital_Eur	Loans_Dom	Loans_Eur	CurrAcc	Survey	IntSpread
Mean	0.4492105	0.3859676	7.309649	.0172118	2.452264	1.668528	.0198384	2.8375	0.2133676
St. Dev.	1.093157	0.8717334	2.45177	.0748084	13.75123	1.388806	1.799318	1.872147	.7203116

Panel B: Regression Results:

Fixed-effects (within) regression — Number of obs = 438
Group variable: countryid — Number of groups = 17
R-sq: within = 0.3486 — Obs per group: avg = 25.8

Variable	Coefficient **L1**	St. Error	t	P-value	95% Confidence	
GDP Growth Rate						
EuroSpread	-0.1466978	0.0744496	-1.97	0.049	-0.2929124	-0.0004832
Capital_Domestic	0.1865276	0.0492129	3.79	0.000	0.0898765	0.2831787
Capital_Eur	1.295674	0.7401575	1.75	0.081	-0.1579498	2.749299
Loans_Domestic	-0.0053766	0.0034581	-1.55	0.121	-0.0121681	0.0014149
Loans_Eur	0.0715481	0.037871	1.89	0.059	-0.0028282	0.1459245
CurrAcc	-0.0449097	0.0277581	-1.62	0.106	-0.0994249	0.0096054
IntSpread	0.5428457	0.1643383	3.30	0.001	0.219802	0.8658895
Survey	3.052693	0.2666291	11.45	0.000	2.528573	3.576812
Intercept	-9.891067	0.7597681	-13.02	0.000	-11.38456	-8.397572

Table VIII

Full Model: Q3 2007 – Q4 2009 **2 Periods Lag**

Panel A: Descriptive Statistics

	GDP	EuroSpread	Capital_Dom	Capital_Eur	Loans_Dom	Loans_Eur	CurrAcc	Survey	IntSpread
Mean	0.4492105	0.3859676	7.309649	.0172118	2.452264	1.668528	.0198384	2.8375	0.2133676
St. Dev.	1.093157	0.8717334	2.45177	.0748084	13.75123	1.388806	1.799318	1.872147	.7203116

Panel B: Regression Results:

Fixed-effects (within) regression — Number of obs = 421
Group variable: countryid — Number of groups = 17
R-sq: within = 0.2631 — Obs per group: avg = 24.8

Variable	Coefficient **L2**	St. Error	t	P-value	95% Confidence	
GDP Growth Rate						
EuroSpread	-0.115289	0.1056438	-1.09	0.276	-0.3229818	0.0924038
Capital_Domestic	0.0584938	0.0657431	0.89	0.374	-0.0707553	0.1877429
Capital_Eur	2.014431	0.9225182	2.18	0.030	0.2007859	3.828077
Loans_Domestic	-0.0077023	0.0041321	-1.86	0.063	-0.0158258	0.0004212
Loans_Eur	-0.1566549	0.0588734	-2.66	0.008	-0.2723984	-0.0409113
CurrAcc	0.0265417	0.0338753	0.78	0.434	-0.0400562	0.0931396
IntSpread	0.4512844	0.1875962	2.41	0.017	0.0824754	0.8200935
Survey	2.585868	0.2949616	8.77	0.000	2.005981	3.165754
Intercept	-7.857192	0.8358169	-9.40	0.000	-9.500385	-6.213999

6.2 Relationship between the Bank Lending Survey and New Loans

Considering the strong results of the **Survey** variable from the previous subsection, it becomes necessary to explore its behavior in more details. As a reminder, it is the aggregated expectations of the euro area banks about the future development of credit standards applied for the approval of new loans to enterprises. First of all, it is reported by the European Central Bank in the beginning of every quarter, in contrast to all other variables under consideration that are calculated at the end of the quarter. Thus, by definition it does not suffer from the same possible reverse causal relationship that may be present in the relationship between change in gross domestic product and the other financial system variables. Nevertheless, the transmission mechanism between its change and change in GDP is less clear.

The problem with the Euro Area Bank Lending Survey variable is that, even though it produces the most significant and straightforward results in all regressions it does not have a direct relationship with industrial output. After all, the theoretical model presenter earlier implies that the financial industry's expectations about the future will have a causal impact on output, but through the level of new loans. It may be possible that the **Survey** variable merely reflects the general short term expectations about the future economic developments and is not really indicative of the banking behavior during the quarter. Thus we have to explore the relationship between the value of **Survey** and the level of new loans for the non-financial industry. The later was demonstrated to be significant and does have a direct economic relationship with both investments and industrial production.

Nonetheless, the problem with this approach is that it would be naïve to think that the lending survey is the only variable that influences lending. That is, we would like to control for other developments during the quarter as well, to obtain better-quality results. For the moment, however, this is not possible as the Euro Area Bank Lending Survey is available for the past 28 quarters only. The size of the sample allow us test merely one variable at a time. Therefore, the change of loans to firms at time t will be regressed on **Survey** with lag up to 3 periods back: $\Delta Loans_t = f(Survey_{t-n})$ where $n \in (0,4)$. Vector autoregressive model with 1 period lag is also applied and Granger causality test was performed on the results of the VAR. All results of the regressions and other necessary data are presented below - tables VIII and VIV and impulse response function of the variables is given on Figure 6.

Table IX
Bank Lending Survey and New Loans

Variable	Coefficient	St. Error	t	P-value	R-squared	Num Obs
Survey	1.565047	1.316091	1.19	0.245	0.0516	28
Intercept	-2.772524	3.744931	-0.74	0.466		
Survey L1	3.640751	1.171706	3.11	0.005	0.2786	27
Intercept	-8.596831	3.326732	-2.58	0.016		
Survey L2	5.469339	0.8457763	6.47	0.000	0.6354	26
Intercept	-13.73119	2.400008	-5.72	0.000		
Survey L3	5.950097	0.6553973	9.08	0.000	0.7818	25
Intercept	-15.05401	1.863299	-8.08	0.000		
Survey L4	6.190606	0.7043927	8.79	0.000	0.7783	24
Intercept	-15.78318	2.012031	-7.84	0.000		

Table X
VAR and Granger Causality Test

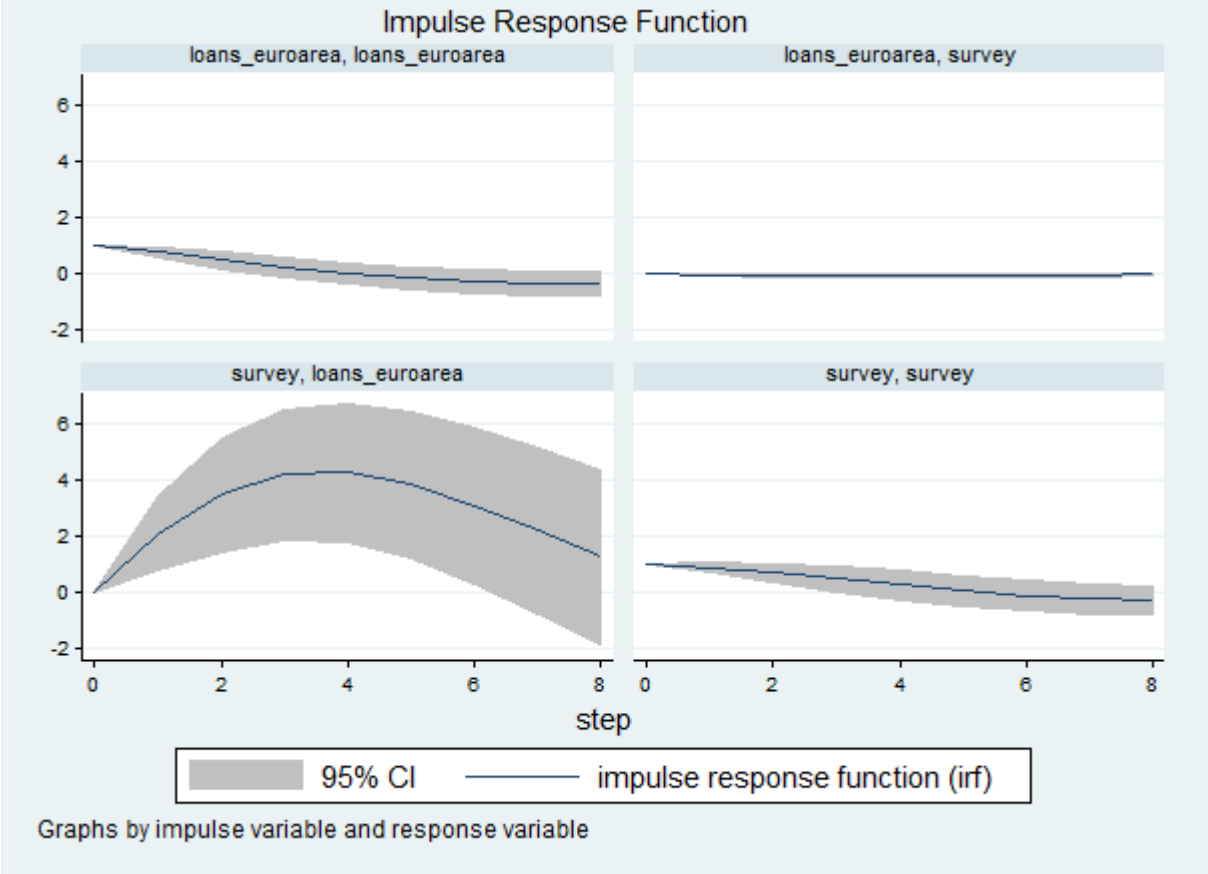
Equation	Parms	RMSE	R-sq	chi2	P>chi2	No. of obs
loans_euroarea	3	0.767628	0.7606	85.76837	0.0000	27
survey	3	0.1061	0.7686	89.70357	0.0000	

Variable	Coef.	Std. Err.	Z	P>|z|
loans_euroarea				
loans_euroarea L1	0.7655775	0.1038448	7.37	0.000
Survey L1	2.12647	0.6812443	3.12	0.002
Const.	-5.66054	1.88671	-3.00	0.003
Survey				
loans_euroarea L1	-0.0393143	.0143532	-2.74	0.006
Survey L1	0.8917366	0.0941603	9.47	0.000
Const.	0.3940211	0.2607774	1.51	0.131

Granger Causality Wald tests				
Equation	Excluded	chi2	df	Prob > chi2
loans_euroarea	survey	9.7434	1	0.002
loans_euroarea	ALL	9.7434	1	0.002
survey	loans_euroarea	7.5024	1	0.006
survey	ALL	7.5024	1	0.006

Probably the most puzzling result from table VIII is that the level of **Survey** is not statistically significant in the same period regression. This was unexpected since the value of the variable exactly reflects the expectations of the banking managers about the lending in the following 3 months. A possible explanation of this phenomenon is that it takes time for the relaxing of the credit standards to actually transform into a higher amount of new loans. All other evidence from the tables actually point into this direction. The coefficient on the **Survey** variable steadily increases and becomes more economically and statistically significant up to 4 periods in the past. After that it gradually declines, becoming insignificant at 5% around t – 6. (Graphical representation of this development is shown in the bottom-left corner of Figure 6 below). The R^2 of the regressions also increase steadily from 0,05 in the same period regression, to the striking 0,78 in the regression with 3 quarters lag. However, it should be noted that in this process some observations are dropped that can amount to 14% of the sample size in the case of 4 lags. This gives more weight to the financial crisis years and may explain the decreasing standard error on the **Survey** coefficients, but even with this in mind the results are strong.

Figure 8: Impulse Response Function of Loans and Survey



The data from the Vector Autoregressive Model suggests that there are two way statistically significant correlations between past observations of **Loans** and **Survey**. From an economic point of view this is not entirely without grounds, since it is certainly reasonable to believe that banking managers take into consideration the recent developments of the lending market when trying to make prediction about the future. This is why the Granger causality tests show two-way causality. Nevertheless, the coefficients on **Loans** are hardly economically significant, in contrast to the coefficients on **Survey**. This can be clearly seen on the impulse response function on Figure 6. Also not surprisingly there is a considerable autocorrelation in both variables, but it is significant only for 2-3 periods back with decreasing coefficients, while the impact of **Survey** on **Loans** is both larger and more lasting. It is possible that there is also a same period effect as predicted, but it is overshadowed by the much stronger lagged effects. Nevertheless, from the available statistics can be concluded that the transmission mechanism of the theoretical model is at least plausible. Predictions of the banks about future lending do materialize as expected and, as explained earlier, lending does have a causal impact on aggregate output. However, we cannot entirely refute the hypothesis that **Survey** variable also includes a direct expectation of the developments in GDP.

6.3 Banking Profitability and GDP

One of the main goals of this research, from the very beginning, was to test the hypothesis that banking losses, or decrease in profits, in a given period will have a significant impact on banks' lending behavior. The simple theoretical model from the previous section predicts that new loans in a period **t** are impacted negatively by the proportion of bad debt during the period - $\frac{dL_{add(t)}}{d\delta_t} < 0$. The decrease in lending then may create a condition for a slower economic growth during the subsequent periods. However, it is virtually impossible to test this variable together with the others as there is almost no data on aggregate, quarterly profitability of the banks in Europe. One possible resolution would be to go through the quarterly financial statements of each bank and aggregate them for each country, but this is extremely time consuming and with uncertain quality. Thus, I have used the annual banking profitability statistics from the OECD Countries database to test this prediction with a similar regression as before:

$$\Delta GDP_t = f(Profit_t, Capital_t, Loans_t, CurrAcc_t).$$

All variables are calculated from OECD statistics for consistency reasons and thus deviate somewhat from the variables in the previous section. For example the change in loans is calculated directly from the aggregate balance sheet and includes the total amount of loans, not only the loans to non-financial corporations, as in the previous subsections. Even in this case data is available only for 16 countries in Europe, even including countries such as Poland and Czech Republic that were previously excluded.

The results of the regression are presented in tables X and XI below. Despite the fact that the goal was to capture the impact of any sub-prime related losses on GDP, this is currently not possible, as data is mostly available only until 2007. Nevertheless, the results allow us to say several things about the relationship in general. The current account and the change of loans seem to have a statistically significant effect on GDP also on annual basis, although with little economic significance. The coefficients on the two variables are respectively only 0,09 and 0,08 (0,18 and 0,02 lagged one period). The coefficients on capital are even negative, but not significant. A possible explanation is that these variables are probably more important in the short run, within one or two quarters, rather than annually. It also might be the case that the yearly observations of CurrAcc, Loans and Capital are too aggregated and do not show the actual development during a given year or there are other variables, not examined here, that have more pronounced medium term effect.

The coefficients of the variable under scrutiny in this subsection, **Profit**, exhibit the same characteristics. Although their signs are as predicted, they are barely economically significant – 0,05 and 0,08 with one period lag. In addition, the same period **Profit** is statistically significant only at 10%. In any case it would be hard to point out with certainty the direction of the causal relationship between GDP and **Profit** within the period. However, the encouraging result here is that the one period lagged **Profit** has both higher coefficient than the same period variable and it is significant at 99% confidence level. In line with this outcome and the expectations of the theoretical model, we find that the change in loans is also correlated with the 1 period lagged **Profit** at 99,9% and the coefficient is 0,55, which is a strong signal that the nature of the relationship justifies the expectations of the model. Nevertheless it would be naïve to conclude only on the basis of these results that banking profits or losses have a causal impact on the economic output of a country in future periods. The issue deserves further, more through, research, preferably on a smaller time scale.

Table XI

Banking Profitability Regression: 1990 – 2008

Yearly observations of GDP growth rate are regressed on 3 banking specific variables and 1 macroeconomic. Data used is for the period 1990 to 2008 for the 16 countries for a total of 248 observations (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Poland, Slovakia, Spain, Sweden and Switzerland). All data is from the OECD countries data base. The second table shows regression of change in loans on profit during the period and with 1 period lag.

R-sq: within = 0.2247 Number of obs = 248

Variable	**Coefficient**	**St. Error**	**t**	**P-value**	**95% Confidence**	
GDP						
Profit	0.0506426	0.0309818	1.63	0.102	-0.0104075	0.1116927
CurrAcc	0.0935347	0.0351257	2.66	0.008	0.0243189	0.1627505
Capital	-0.0571638	0.103997	-0.55	0.583	-0.2620915	0.1477639
Loans	0.0755748	.0109317	6.91	0.000	0.0540337	0.0971159
Intercept	2.250631	0.6457683	3.49	0.001	0.9781341	3.523128

Loans	Coefficient	St. Error	t	P-value	R-squared	Num Obs
Profit	0.1515477	0.1646847	0.92	0.358	0.0034	267
Profit L1	0.5517412	0.162235	3.40	0.001	0.0469	252

Table XII

Banking Profitability Regression: 1990 – 2008 **1 Period Lag**

R-sq: within = 0.1427 Number of obs = 246

Variable	**Coefficient L1**	**St. Error**	**t**	**P-value**	**95% Confidence**	
GDP						
Profit	0.0843227	0.0325942	2.59	0.010	0.0200983	0.148547
CurrAcc	0.1821826	0.0403612	4.51	0.000	0.102654	0.2617112
Capital	-0.204621	0.1169227	-1.75	0.081	-0.4350082	0.0257663
Loans	0.0248126	0.0122836	2.02	0.045	0.0006088	0.0490164
Intercept	3.391631	0.7282882	4.66	0.000	1.956595	4.826667

6.4 Extensions

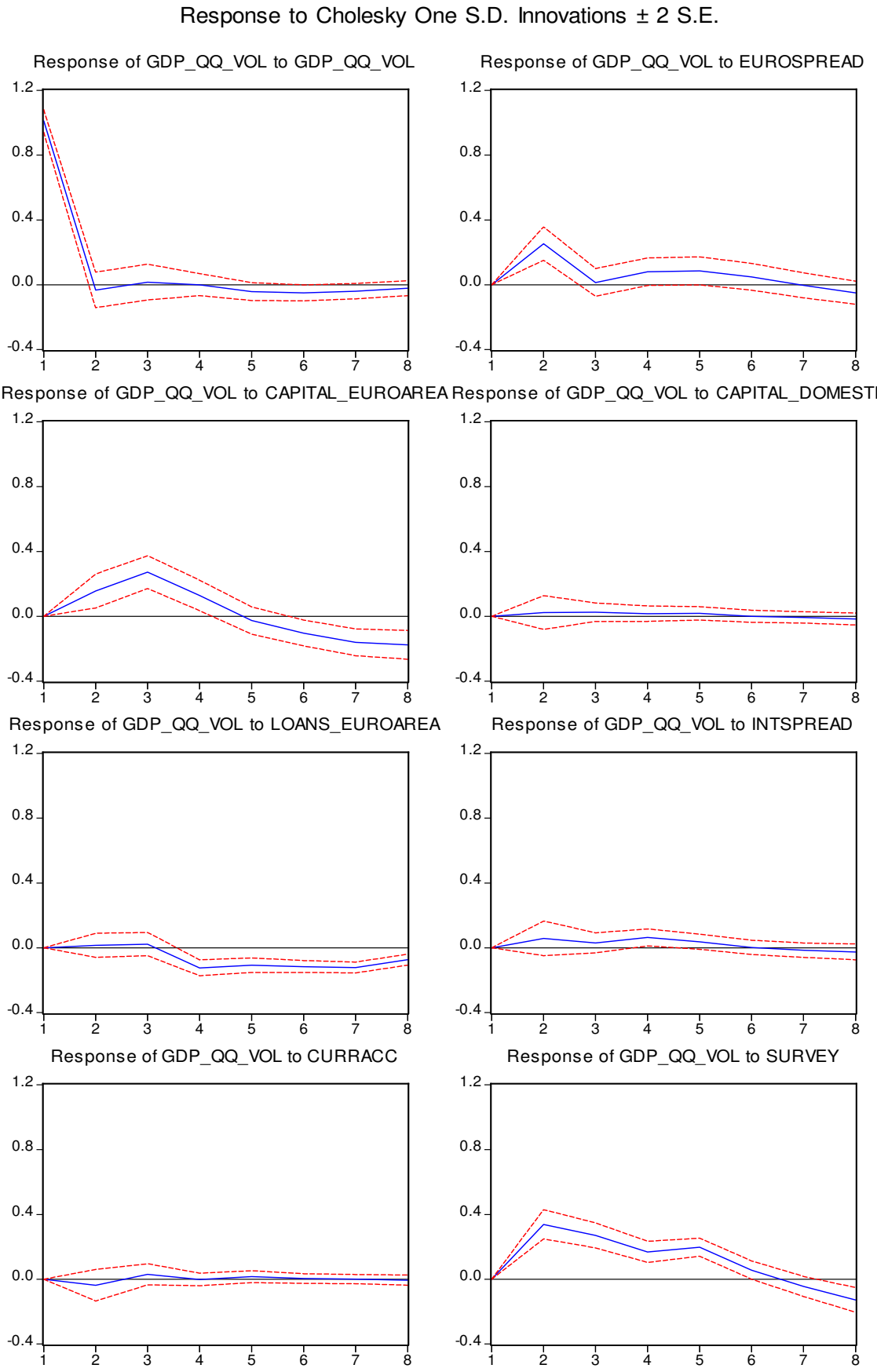
In addition to the results already presented and discusses earlier in the section, a panel vector autoregression model was also performed on all variables to explore the possible interdependencies between them. A total of nine equations were estimated with two lags for each variable. The outcome of the model is given in Appendix I as it tends to be quite voluminous. It would have been much useful to estimate the model for the two periods, Normal and Financial Crisis, separately but the small number of observations does not allow this for the time being. In our case one equation consists of 19 independent variables and the sample size is only 421. The **Financial Crisis** period takes up almost half of total time period in the model. Instead of this, the results of a Granger causality test for the two periods are reported in Table XII and give us a strong hint of the potential differences between them. In addition, a graph of the impulse response functions during the financial crisis period with response variable GDP is given in Figure 7. Graphs with the other response variables are also found in Appendix II.

The VAR model generally confirms the results given by the baseline model earlier in the section. The aggregate output of an economy is significantly impacted by the lagged values of banking variables such as **Eurospread** and **Survey** and their respective signs are mostly in line with the expectations. On the other hand the variables that measure the change in loans to non-financial companies on domestic and aggregate scale are surprisingly not statistically significant. The equation with GDP as a dependent variable has the smallest R-Squared of only 0,37 compared to values above 0,80 for all other equations. This is not unexpected and comes to show that there is a significant correlation between the financial system variables and that even if the theory laid out here is correct, banks cannot completely account for the development of the economic conditions. The high correlation between **Loans** and the other banking specific variables, together with the small sample size, may explain why **Loans** appears statistically insignificant in the model. Its R-squared is remarkable 0,91. However the result that strongly supports the theoretical background here is that past values of GDP do not seem to have a statistically significant correlation with the banking specific variables, with the only exception of **Eurospread** and **Capital_Eur.** The other non-financial variable, the current account balance, also does not seem impact significantly either the financial variables or GDP. Thus, the developments of the financial system are more or less endogenous. To explore these issues further we have to take a look at the results of the Granger causality test below.

Table XIII – Granger Causality Test (Excerpt Results)

null hypothesis: A -> B A does not Granger-cause B	Normal Period			Financial Crisis		
	Obs	F-Statistic	Probability	Obs	F-Statistic	Probability
eurospread -> gdp_qq_vol	494	1,0071	0,3660	190	5,1070	0,0069
gdp_qq_vol -> eurospread		0,6886	0,5028		56,8619	0,0000
capital_euroarea -> gdp_qq_vol	494	0,8458	0,4298	190	3,6953	0,0267
gdp_qq_vol -> capital_euroarea		0,9753	0,3778		34,2593	0,0000
capital_domestic -> gdp_qq_vol	428	2,3541	0,0962	180	0,9251	0,3984
gdp_qq_vol -> capital_domestic		0,4538	0,6355		3,4275	0,0347
loans_euroarea -> gdp_qq_vol	494	0,1755	0,8391	190	2,6291	0,0748
gdp_qq_vol -> loans_euroarea		3,6721	0,0261		36,0535	0,0000
loans_domestic -> gdp_qq_vol	434	0,1219	0,8853	180	4,6478	0,0108
gdp_qq_vol -> loans_domestic		0,3277	0,7208		0,9201	0,4004
intspread -> gdp_qq_vol	245	2,5814	0,0778	170	1,4062	0,2480
gdp_qq_vol -> intspread		0,3123	0,7320		5,5210	0,0048
curracc -> gdp_qq_vol	494	9,9859	0,0001	190	0,3206	0,7261
gdp_qq_vol -> curracc		3,6524	0,0266		4,8911	0,0085
survey -> gdp_qq_vol	266	0,7827	0,4582	190	45,3027	0,0000
gdp_qq_vol -> survey		1,8415	0,1606		6,7907	0,0014
capital_euroarea -> eurospread	494	3,2709	0,0388	190	0,0602	0,9416
eurospread -> capital_euroarea		7,0152	0,0010		75,6490	0,0000
capital_domestic -> eurospread	428	0,1457	0,8644	180	1,0996	0,3353
eurospread -> capital_domestic		0,3106	0,7332		5,0320	0,0075
loans_euroarea -> eurospread	494	0,3668	0,6932	190	26,0580	0,0000
eurospread -> loans_euroarea		8,5667	0,0002		29,9839	0,0000
loans_domestic -> eurospread	434	2,2241	0,1094	180	12,4070	0,0000
eurospread -> loans_domestic		0,6503	0,5224		0,5718	0,5656
intspread -> eurospread	245	5,2399	0,0059	170	7,6790	0,0007
eurospread -> intspread		0,4172	0,6594		6,0425	0,0029

Figure 9: Impulse Response Function Excerpt



The results of the Granger causality test are reported in two columns for the two different time periods in Table XII. The first thing to notice is the differences between the effects of the current account on GDP during the normal period and the financial crisis. From the baseline model we have established that **CurrAcc** is one of the most significant variables in the model, which is not surprising as the European economies are relatively open and the trade balance enters directly into the calculation of GDP. We see than during the normal period **CurrAcc** Granger-causes **GDP** and vice-versa, but during the financial crisis this is no longer the case. Only **GDP** affects the variable and the current account loses its predicting abilities. This is especially evident on the bottom left corner of impulse response functions during the financial crisis in Figure 6. Usually we would expect that at the beginning of a global slump the contagion will spread from the affected economies to healthy ones through trade. If we make the reasonable assumption that at the beginning of the recent recession the European economies were in fact 'healthy', with some degree of certainty we can say that the spillover effect did not come through the typical channels, as all results point in this direction. Although a circumstantial evidence, this supports the hypothesis that banks not only contributed to the recession in Europe by the usual financial accelerator and liquidity spiral effects, but had a large part in causing it.

At the same time, the other results of the Granger causality test directly support this proposition. All banking specific variables are insignificant during the normal period, but Granger-cause **GDP** during the financial crisis period at very high significance levels. This is especially evident for **EuroSpread**, **Capital** and **Survey.** Even the **Loans** that had no significant results in the vector autoresgression Granger-causes **GDP** at 90% for the aggregate variable. This once again supports the notion of a transmission mechanism of shocks from the financial industry to the real economy through the supply of new loans. Moreover we see that the aggregate output also has a considerable causal impact on the financial system, in contrast to the results of the VAR model. During normal times this occurrence is self explanatory as it should be the regular direction of the causal relationship, but during the recession it may be an evidence of multiplier effect. On the other hand, we also observe strong two-way causality between almost all of the banking specific variables, which confirms the results of the VAR. The correlation between them is a sign for simultaneous processes in the financial system, especially during the period of the financial crisis. Although we are not able to disentangle these processes at the moment, the overall results of the test give considerable support to the propositions about the role of banks in the economic problems in Europe during 2007-2009.

7. Conclusion

This paper presents a theoretical model of the transmission of a shock from the financial system to the overall economy and tests the suggested effects on European macroeconomic data in the period 2000-2009. The rationale for the existence of such a transmission mechanism and its procyclical effects on economic activity are deeply rooted in previous research on the topics of financial crises and recessions. The high level of development of the financial system is one of the preconditions for long term growth, but during financial turbulence its action may be in fact harmful for the other economic subjects. Therefore, financial deepening should not be the sole motive for deregulations and should never happen at the expense of more fragile and risky financial system. Indeed, it ought to be closely connected to the efficiency of intermediation through the economic cycle.

Due to the high level of leverage in the financial system, any sudden increase in losses may lead to rapid deleveraging through decreasing lending or selling assets. At the same time, leverage and liquidity have a two way causal relationship. Thus, deleveraging may lead to liquidity spirals in which the prices of assets continue to fall and banks are unable to obtain short-term financing to roll their debts, inducing further assets fire sales. This is basically what happened during the financial crisis, which transferred to Europe despite the fact that the region was not prone to the same macroeconomic imbalances as the country of origin. Nowadays the financial system is greatly globalized and a shock in one place is felt immediately all over the world. At the same time, when the banks are concerned about their future access to liquidity, they cut back on lending to the real economy to conserve capital. In this way, a pure financial crisis can develop into a full scale global recession.

The results of the empirical section of the paper show that a shock to the perceived risk in the financial system does affect negatively the aggregate economic activity during the same period and in the future periods. Moreover, the expectations of the banking managers about the future state of the economy may turn into self-fulfilling prophecies. Both effects happen mostly through the lending channel to non-financial corporations. Also as expected, there is a positive correlation between the capital in the banking system and economic growth. During bad times it absorbs the shocks to the system and limits the deleveraging. Surprisingly, banks did not widen the interest spread between deposits and loans to account for the higher risk premium during the crisis. At the end, results show that the recession in Europe was most probably “imported” through the financial system and its procyclical effects on the economy.

8. Appendices

Appendix I: Vector Autoregression Estimates

Sample (adjusted): 174 199

Included observations: 421 after adjustments

	GDP_QQ_VOL	EUROSPREAD	CAPITAL_EUR	CAPITAL_DOM	LOANS_EUR	LOANS_DOM	INTSPREAD	CURRACC	SURVEY
GDP_QQ_VOL(-1)	0.005241	-0.123161	-0.012577	-0.001305	-0.000120	0.120621	-0.020943	-0.055488	-0.010110
Standard errors	(0.05061)	(0.01873)	(0.00286)	(0.02188)	(0.02208)	(0.73637)	(0.00765)	(0.07176)	(0.00419)
t-statistics	[0.10356]	[-6.57525]	[-4.39440]	[-0.05964]	[-0.00544]	[0.16381]	[-2.73887]	[-0.77327]	[-2.41336]
GDP_QQ_VOL(-2)	0.090218	-0.026645	-0.008417	-0.021213	0.029648	0.281148	0.003214	-0.098795	-0.001408
Standard errors	(0.05295)	(0.01960)	(0.00299)	(0.02289)	(0.02310)	(0.77042)	(0.00800)	(0.07508)	(0.00438)
t-statistics	[1.70386]	[-1.35962]	[-2.81108]	[-0.92682]	[1.28326]	[0.36493]	[0.40180]	[-1.31593]	[-0.32120]
EUROSPREAD(-1)	-0.318636	0.927867	0.078587	0.075543	-0.219739	0.737768	0.021025	0.127061	0.037355
Standard errors	(0.13403)	(0.04961)	(0.00758)	(0.05794)	(0.05848)	(1.95016)	(0.02025)	(0.19004)	(0.01109)
t-statistics	[- 2.37735]	[18.7046]	[10.3684]	[1.30390]	[-3.75733]	[0.37831]	[1.03823]	[0.66860]	[3.36701]
EUROSPREAD(-2)	-0.499995	-0.211729	-0.031227	-0.093269	-0.207657	1.775056	-0.006351	0.235024	-0.043433
Standard errors	(0.15049)	(0.05570)	(0.00851)	(0.06505)	(0.06567)	(2.18968)	(0.02274)	(0.21338)	(0.01246)
t-statistics	[-3.32242]	[-3.80130]	[-3.66933]	[-1.43376]	[-3.16235]	[0.81065]	[-0.27932]	[1.10143]	[-3.48667]
CAPITAL_EUROAREA(-1)	0.358374	0.605006	0.041987	0.153827	1.847423	-2.805226	0.157697	0.478126	0.196617
Standard errors	(0.84915)	(0.31428)	(0.04802)	(0.36706)	(0.37052)	(12.3553)	(0.12830)	(1.20400)	(0.07029)
t-statistics	[0.42204]	[1.92504]	[0.87437]	[0.41908]	[4.98606]	[-0.22705]	[1.22915]	[0.39711]	[2.79729]
CAPITAL_EUROAREA(-2)	0.602784	1.057697	-0.272161	0.105393	1.623674	-0.065795	0.193898	-0.811554	0.021219
Standard errors	(0.88492)	(0.32752)	(0.05004)	(0.38252)	(0.38613)	(12.8757)	(0.13370)	(1.25472)	(0.07325)
t-statistics	[0.68118]	[3.22941]	[-5.43856]	[0.27552]	[4.20505]	[-0.00511]	[1.45023]	[-0.64680]	[0.28969]

CAPITAL_DOMESTIC(-1)	-0.016743	-0.011051	0.000653	0.963091	0.019541	1.557954	-0.021868	-0.080120	-0.010214
Standard errors	(0.11840)	(0.04382)	(0.00670)	(0.05118)	(0.05166)	(1.72278)	(0.01789)	(0.16788)	(0.00980)
t-statistics	[-0.14141]	[-0.25218]	[0.09755]	[18.8172]	[0.37823]	[0.90432]	[-1.22240]	[-0.47724]	[-1.04214]
CAPITAL_DOMESTIC(-2)	0.011521	0.007102	-8.42E-05	0.025662	-0.023053	-1.515988	0.029818	0.101453	0.009812
Standard errors	(0.11869)	(0.04393)	(0.00671)	(0.05131)	(0.05179)	(1.72699)	(0.01793)	(0.16829)	(0.00982)
t-statistics	[0.09707]	[0.16167]	[-0.01255]	[0.50017]	[-0.44512]	[-0.87782]	[1.66273]	[0.60284]	[0.99866]
LOANS_EUROAREA(-1)	0.050519	-0.050806	-0.007428	-0.032935	0.087272	1.613318	-0.000705	-0.036803	0.018172
Standard errors	(0.07981)	(0.02954)	(0.00451)	(0.03450)	(0.03482)	(1.16122)	(0.01206)	(0.11316)	(0.00661)
t-statistics	[0.63301]	[-1.72001]	[-1.64594]	[-0.95467]	[2.50614]	[1.38933]	[-0.05847]	[-0.32524]	[2.75082]
LOANS_EUROAREA(-2)	-0.063167	0.054373	0.008696	0.014812	0.457152	-0.414044	0.000696	0.011050	-0.066863
Standard errors	(0.06936)	(0.02567)	(0.00392)	(0.02998)	(0.03026)	(1.00915)	(0.01048)	(0.09834)	(0.00574)
t-statistics	[-0.91075]	[2.11816]	[2.21726]	[0.49406]	[15.1059]	[-0.41029]	[0.06638]	[0.11237]	[-11.6465]
LOANS_DOMESTIC(-1)	-0.006005	-0.004789	-0.000385	0.000946	0.000400	-0.239051	-0.000935	-0.009527	-0.000650
Standard errors	(0.00392)	(0.00145)	(0.00022)	(0.00169)	(0.00171)	(0.05703)	(0.00059)	(0.00556)	(0.00032)
t-statistics	[-1.53184]	[-3.30127]	[-1.73854]	[0.55855]	[0.23391]	[-4.19132]	[-1.57800]	[-1.71420]	[-2.00428]
LOANS_DOMESTIC(-2)	-0.005287	0.001767	8.69E-05	-0.001556	2.66E-05	-0.033243	-0.000141	-0.004442	-0.000371
Standard errors	(0.00402)	(0.00149)	(0.00023)	(0.00174)	(0.00176)	(0.05856)	(0.00061)	(0.00571)	(0.00033)
t-statistics	[-1.31368]	[1.18594]	[0.38187]	[-0.89429]	[0.01516]	[-0.56764]	[-0.23184]	[-0.77839]	[-1.11271]
INTSPREAD(-1)	0.256281	-0.498335	0.024522	0.051626	0.108431	0.526947	0.977050	-0.808308	-0.013443
Standard errors	(0.34012)	(0.12588)	(0.01923)	(0.14702)	(0.14841)	(4.94881)	(0.05139)	(0.48225)	(0.02815)
t-statistics	[0.75350]	[-3.95870]	[1.27491]	[0.35115]	[0.73063]	[0.10648]	[19.0130]	[-1.67611]	[-0.47749]

INTSPREAD(-2)	-0.123184	0.395313	-0.022995	-0.036313	-0.138851	-1.034713	-0.018837	0.841129	0.014667
Standard errors	(0.34459)	(0.12754)	(0.01949)	(0.14896)	(0.15036)	(5.01389)	(0.05206)	(0.48859)	(0.02852)
t-statistics	[-0.35748]	[3.09956]	[-1.18000]	[-0.24378]	[-0.92346]	[-0.20637]	[-0.36181]	[1.72153]	[0.51420]
CURRACC(-1)	-0.008222	0.018695	0.001411	0.020025	-0.013285	-0.062450	0.000527	-0.402801	0.001205
Standard errors	(0.03479)	(0.01288)	(0.00197)	(0.01504)	(0.01518)	(0.50626)	(0.00526)	(0.04933)	(0.00288)
t-statistics	[-0.23632]	[1.45173]	[0.71729]	[1.33144]	[-0.87507]	[-0.12336]	[0.10028]	[-8.16474]	[0.41824]
CURRACC(-2)	0.019275	0.011768	-0.001533	-0.001802	0.001512	-0.057592	0.000844	-0.034698	0.004799
Standard errors	(0.03418)	(0.01265)	(0.00193)	(0.01478)	(0.01492)	(0.49738)	(0.00516)	(0.04847)	(0.00283)
t-statistics	[0.56385]	[0.93013]	[-0.79299]	[-0.12192]	[0.10135]	[-0.11579]	[0.16348]	[-0.71587]	[1.69598]
SURVEY(-1)	4.118022	0.117577	0.001781	0.173510	-0.828118	10.66420	0.247797	0.043759	0.856078
Standard errors	(0.55085)	(0.20388)	(0.03115)	(0.23811)	(0.24036)	(8.01497)	(0.08323)	(0.78105)	(0.04560)
t-statistics	[7.47576]	[0.57670]	[0.05719]	[0.72869]	[-3.44535]	[1.33054]	[2.97734]	[0.05603]	[18.7750]
SURVEY(-2)	-0.975292	-0.833602	0.045053	-0.126337	4.431905	-11.71562	-0.253218	0.013831	0.025586
Standard errors	(0.64149)	(0.23742)	(0.03628)	(0.27729)	(0.27991)	(9.33375)	(0.09692)	(0.90956)	(0.05310)
t-statistics	[-1.52036]	[-3.51104]	[1.24194]	[-0.45561]	[15.8335]	[-1.25519]	[-2.61260]	[0.01521]	[0.48186]
C	-8.750757	2.500011	-0.144216	-0.032156	-9.233015	3.639311	0.013616	-0.416401	0.449056
Standard errors	(0.99576)	(0.36854)	(0.05631)	(0.43043)	(0.43449)	(14.4885)	(0.15045)	(1.41188)	(0.08242)
t-statistics	[-8.78803]	[6.78347]	[-2.56106]	[-0.07471]	[-21.2502]	[0.25119]	[0.09050]	[-0.29493]	[5.44813]
R-squared	0.369059	0.873216	0.553631	0.970028	0.913011	0.070051	0.946579	0.193484	0.834594
Adj. R-squared	0.340808	0.867539	0.533644	0.968686	0.909116	0.028412	0.944187	0.157371	0.827188
F-statistic	13.06355	153.8190	27.70001	722.7979	234.4040	1.682324	395.7305	5.357774	112.6883
Log likelihood	-607.7054	-189.2553	601.6662	-254.6063	-258.5564	-1734.977	187.9345	-754.7065	441.2704

Appendix II: Granger Causality Test

null hypothesis: A -> B A does not Granger-cause B	Normal Period				Financial Crisis		
	Obs	F-Statistic	Probability		Obs	F-Statistic	Probability
eurospread -> gdp_qq_vol	494	1,0071	0,3660		190	5,1070	0,0069
gdp_qq_vol -> eurospread		0,6886	0,5028			56,8619	0,0000
capital_euroarea -> gdp_qq_vol	494	0,8458	0,4298		190	3,6953	0,0267
gdp_qq_vol -> capital_euroarea		0,9753	0,3778			34,2593	0,0000
capital_domestic -> gdp_qq_vol	428	2,3541	0,0962		180	0,9251	0,3984
gdp_qq_vol -> capital_domestic		0,4538	0,6355			3,4275	0,0347
loans_euroarea -> gdp_qq_vol	494	0,1755	0,8391		190	2,6291	0,0748
gdp_qq_vol -> loans_euroarea		3,6721	0,0261			36,0535	0,0000
loans_domestic -> gdp_qq_vol	434	0,1219	0,8853		180	4,6478	0,0108
gdp_qq_vol -> loans_domestic		0,3277	0,7208			0,9201	0,4004
intspread -> gdp_qq_vol	245	2,5814	0,0778		170	1,4062	0,2480
gdp_qq_vol -> intspread		0,3123	0,7320			5,5210	0,0048
curracc -> gdp_qq_vol	494	9,9859	0,0001		190	0,3206	0,7261
gdp_qq_vol -> curracc		3,6524	0,0266			4,8911	0,0085
survey -> gdp_qq_vol	266	0,7827	0,4582		190	45,3027	0,0000
gdp_qq_vol -> survey		1,8415	0,1606			6,7907	0,0014
capital_euroarea -> eurospread	494	3,2709	0,0388		190	0,0602	0,9416
eurospread -> capital_euroarea		7,0152	0,0010			75,6490	0,0000
capital_domestic -> eurospread	428	0,1457	0,8644		180	1,0996	0,3353
eurospread -> capital_domestic		0,3106	0,7332			5,0320	0,0075
loans_euroarea -> eurospread	494	0,3668	0,6932		190	26,0580	0,0000
eurospread -> loans_euroarea		8,5667	0,0002			29,9839	0,0000
loans_domestic -> eurospread	434	2,2241	0,1094		180	12,4070	0,0000
eurospread -> loans_domestic		0,6503	0,5224			0,5718	0,5656
intspread -> eurospread	245	5,2399	0,0059		170	7,6790	0,0007
eurospread -> intspread		0,4172	0,6594			6,0425	0,0029

curracc -> eurospread	494	3,4957	0,0311		190	0,2806	0,7557
eurospread -> curracc		0,6142	0,5415			5,9686	0,0031
survey -> eurospread	266	3,5598	0,0298		190	55,5244	0,0000
eurospread -> survey		18,0633	0,0000			30,4944	0,0000
capital_domestic -> capital_euroarea	428	0,0688	0,9335		180	1,3295	0,2673
capital_euroarea -> capital_domestic		0,2225	0,8006			2,1812	0,1160
loans_euroarea -> capital_euroarea	494	24,8517	0,0000		190	81,6050	0,0000
capital_euroarea -> loans_euroarea		4,8241	0,0084			98,6744	0,0000
loans_domestic -> capital_euroarea	434	3,0378	0,0490		180	5,0252	0,0076
capital_euroarea -> loans_domestic		1,0836	0,3393			0,1765	0,8384
intspread -> capital_euroarea	245	0,7708	0,4638		170	3,8427	0,0234
capital_euroarea -> intspread		0,3841	0,6815			6,4360	0,0020
curracc -> capital_euroarea	494	0,5323	0,5876		190	2,8915	0,0580
capital_euroarea -> curracc		2,0869	0,1252			2,9672	0,0539
survey -> capital_euroarea	266	24,2837	0,0000		190	144,0360	0,0000
capital_euroarea -> survey		78,7753	0,0000			62,5895	0,0000
loans_euroarea -> capital_domestic	428	0,9705	0,3797		180	4,5245	0,0121
capital_domestic -> loans_euroarea		0,0149	0,9852			2,0755	0,1286
loans_domestic -> capital_domestic	400	0,8736	0,4182		170	3,6288	0,0287
capital_domestic -> loans_domestic		1,5154	0,2210			0,8444	0,4317
intspread -> capital_domestic	245	0,1141	0,8922		170	1,9758	0,1419
capital_domestic -> intspread		1,8667	0,1569			2,2860	0,1049
curracc -> capital_domestic	428	0,3785	0,6851		180	1,1030	0,3342
capital_domestic -> curracc		0,3064	0,7363			0,9374	0,3936
survey -> capital_domestic	236	0,6884	0,5034		180	4,5671	0,0117
capital_domestic -> survey		0,1757	0,8390			0,3901	0,6776
loans_domestic -> loans_euroarea	434	0,8245	0,4392		180	0,3848	0,6812
loans_euroarea -> loans_domestic		0,6952	0,4995			0,0928	0,9114

intspread -> loans_euroarea	245	2,8959	0,0572		170	1,8734	0,1569
loans_euroarea -> intspread		0,4492	0,6387			7,2698	0,0009
curracc -> loans_euroarea	494	0,1512	0,8597		190	0,6909	0,5024
loans_euroarea -> curracc		0,7761	0,4608			7,2622	0,0009
survey -> loans_euroarea	266	87,0759	0,0000		190	577,3690	0,0000
loans_euroarea -> survey		35,5406	0,0000			111,7170	0,0000
intspread -> loans_domestic	245	0,1152	0,8913		170	0,9971	0,3712
loans_domestic -> intspread		0,3975	0,6724			3,8436	0,0234
curracc -> loans_domestic	434	0,4125	0,6623		180	0,4557	0,6347
loans_domestic -> curracc		0,1992	0,8194			1,0114	0,3658
survey -> loans_domestic	242	0,3000	0,7411		180	3,2862	0,0397
loans_domestic -> survey		0,0751	0,9277			0,3694	0,6917
curracc -> intspread	245	0,2454	0,7826		170	1,1802	0,3098
intspread -> curracc		0,0204	0,9798			0,2158	0,8061
survey -> intspread	217	2,7391	0,0669		170	10,9220	0,0000
intspread -> survey		0,9061	0,4057			0,8479	0,4302
survey -> curracc	266	0,1225	0,8848		190	6,1963	0,0025
curracc -> survey		0,3807	0,6838			3,5185	0,0316

Appendix 3: Additional Robustness Tests

Figure 10: Unemployment, Full Model Regression

Fixed-effects (within) regression — Number of obs = 455
Group variable: countryid — Number of groups = 17
R-sq: within = 0.2560 — Obs per group: avg = 26.8

Variable	Coefficient	St. Error	t	P-value
Unemployment				
EuroSpread	0.1579115	0.0935735	1.69	0.092
Capital_Domestic	-0.0327926	0.0647815	-0.51	0.613
Capital_Eur	-0.2253188	0.8922037	-0.25	0.801
Loans_Domestic	-0.0054821	0.0037494	-1.46	0.144
Loans_Eur	-0.3693794	0.0570285	-6.48	0.000
CurrAcc	0.0605442	0.0341134	1.77	0.077
IntSpread	-0.2524534	0.17671	-1.43	0.154
Survey	1.516692	0.2894313	5.24	0.000
Intercept	3.989404	0.8254109	4.83	0.000

Figure 11: Unemployment, 1 Period Lag

Fixed-effects (within) regression — Number of obs = 438
Group variable: countryid — Number of groups = 17
R-sq: within = 0.2594 — Obs per group: avg = 25.8

Variable	Coefficient **L1**	St. Error	t	P-value
Unemployment				
EuroSpread	0.1971486	0.1030477	1.91	0.056
Capital_Domestic	-0.091715	0.0669069	-1.37	0.171
Capital_Eur	-0.0976589	0.9162136	-0.11	0.915
Loans_Domestic	-0.0077912	0.0042203	-1.85	0.066
Loans_Eur	-0.3952815	0.0590288	-6.70	0.000
CurrAcc	0.0764954	0.0348415	2.20	0.029
IntSpread	-0.2366781	0.18563	-1.27	0.203
Survey	0.5958978	0.3011737	1.98	0.049
Intercept	7.082095	0.858204	8.25	0.000

Figure 12: Industrial Production, Full Model Regression

Fixed-effects (within) regression	Number of obs = 455
Group variable: countryid	Number of groups = 17
R-sq: within = 0.3118	Obs per group: avg = 26.8

Variable	Coefficient	St. Error	t	P-value
Industrial Product				
EuroSpread	0.0026151	0.1932695	0.01	0.989
Capital_Domestic	0.3423991	0.1338015	2.56	0.011
Capital_Eur	4.174088	1.842783	2.27	0.024
Loans_Domestic	0.0109877	0.0077441	1.42	0.157
Loans_Eur	0.3892962	0.1177884	3.31	0.001
CurrAcc	-0.0168746	0.0704588	-0.24	0.811
IntSpread	1.666382	0.3649819	4.57	0.000
Survey	5.090864	0.5977997	8.52	0.000
Intercept	-20.88834	1.704827	-12.25	0.000

Figure 13: Industrial Production, 1 Period Lag

Fixed-effects (within) regression	Number of obs = 438
Group variable: countryid	Number of groups = 17
R-sq: within = 0.2594	Obs per group: avg = 25.8

Variable	Coefficient **L1**	St. Error	t	P-value
Industrial Product				
EuroSpread	0.5375632	0.2123154	2.53	0.012
Capital_Domestic	0.2616471	0.1378523	1.90	0.058
Capital_Eur	0.7961323	1.88773	0.42	0.673
Loans_Domestic	-0.0063117	0.0086954	-0.73	0.468
Loans_Eur	0.0858273	0.1216206	0.71	0.481
CurrAcc	0.2214451	0.0717861	3.08	0.002
IntSpread	1.301861	0.3824646	3.40	0.001
Survey	6.285332	0.6205263	10.13	0.000
Intercept	-22.65879	1.768209	-12.81	0.000

9. References

Abreu, D., Brunnermeier, M. (2003).“Bubbles and Crashes.” Econometrica 71: 173–204.

Adrian, T., Shin, H.S. (2008a). “Liquidity and leverage.” Journal of Financial Intermediation, In Press, Corrected Proof, Available online 24 December 2008.

Adrian, T., Shin, H.S. (2008b). “Financial Intermediary Leverage and Value-at-Risk.” Federal Bank of New York, Staff Report No.338 .

Adrian, T., Shin, H.S. (2009). “Money, Liquidity and Monetary Policy” American Economic Review: Papers & Proceedings 2009 99: 600–605.

Barth, T., Caprio, G., Levine, R. (2004). “Bank regulation and supervision: What works best?.” Journal of Financial Intermediation 13, 205-248.

Beck, T., Demirgüç-Kunt, A., Levine, R. (2000). “A new database on financial development and structure.” *World Bank Economic Review* 14: 597-605.

Beltratti, A., Stulz, R. (2009). “Why did some banks perform better during the credit crisis? A cross-country study of the impact of governance and regulation.” Fisher College of Business Working Paper No. 2009-03-012..

Berger, A., Bouwman, C. (2009). “Bank liquidity creation, monetary policy, and financial crises,” working paper.

Bernanke, B., Gertler, M., Gilchrist, S. (1998). “The Financial Accelerator in a Quantitative Business Cycle Framework.” NBER Working Paper No. W6455.

Bernanke, B., Gertler, M., Gilchrist, S. (1996). “The Financial Accelerator and the Flight to Quality.” Review of Economics and Statistics, 78: 1–15.

Borio, C., Furfine, C., Lowe, L. (2001). “Procyclicality of the financial system and financial stability: issues and policy options.” BIS Papers 1: 1-57.

Brunnermeier, M. (2009), “Deciphering the liquidity and credit crunch 2007-2008,” *Journal of Economic Perspectives* 23, 77-100.

Brunnermeier, M., Pedersen, L. (2008). “Market Liquidity and Funding Liquidity,” Review of Financial Studies 22: 2201-2238.

Caballero, R., Krishnamurthy, A. (2007). “Collective Risk Management in a Flight to Quality Episode.” NBER Working Paper No.W12896, forthcoming: Journal of Finance.

Demirgüc-Kunt, A., Huizinga, H. (2009). "Bank activity and funding strategies: The impact on risk and return." CEPR Discussion Paper No. DP7170.

Demirgüc-Kunt, A., Laeven, L., Levine, R. (2004). "Regulations, market structure, institutions, and the cost of financial intermediation." Journal of Money, Credit and Banking 36: 593-622.

Edwards, S., Vegh, C. (1997). "Banks and macroeconomic disturbances under predetermined exchange rates." Journal of Monetary Economics 40: 239-278.

Fahlenbrach, R., Stulz, R. (2009). "Bank CEO incentives and the credit crisis." Charles A Dice Center Working Paper No. 2009-13.

Foos, D., Norden, L., Weber, M. (2010). "Loan Growth and Riskiness of Banks." Working paper.

Gatev, E., Strahan, P. (2006) "Banks' advantage in hedging liquidity risk: Theory and evidence from the commercial paper market." Journal of Finance 61: 867-892.

Hellwig, M. (2009). "Systemic Risk in the Financial Sector: An Analysis of the Subprime-Mortgage Financial Crisis." De Economist 157: 129-207.

Hendel, I. (1996). "Competition Under Financial Distress." The Journal of Industrial Economics 44: 309-324.

Holmström, B., Tirole, J. (1997). "Financial Intermediation, Loanable Funds, and the Real Sector." Quarterly Journal of Economics 112: 663–691.

International Monetary Fund (2008), "Global Financial Stability Report: Financial Stress and Deleveraging" October 2008.

Jensen, M., Meckling, W. (1976), "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure", Journal of Financial Economics 3: 305-360.

Kashyap, A., Rajan, R., Stein, J. (2002) "Banks as liquidity providers: An explanation for the coexistence of lending and deposit-taking." Journal of Finance 57: 33-73.

Kashyap, A., Rajan, R., Stein, J. (2008) "Rethinking Capital Regulation." Federal Reserve Bank of Kansas City, Symposium at Jackson Hole: 431-471.

Kashyap, A., Stein, J. (2000). "What do a million observations on banks say about the transmission of monetary policy?" American Economic Review 90: 407-428.

Kao, D., Shumaker, R. (1999). "Equity Style Timing". Financial Analysts Journal 55: 37-48.

King, R., Levine, R. (1993). “Finance and Growth: Schumpeter might be Right.” The Quarterly Journal of Economics 108: 717-737.

Kiyotaki, N., Moore, J. (1997). “Credit Cycles.” Journal of Political Economy 105: 211–48.

Laeven, L., Levine, R. (2009). “Bank governance, regulation, and risk taking.” Journal of Financial Economics 93: 259-275.

Laeven, L., Valencia, F. (2009). “Systemic banking crises: A new database.” IMF Working Paper No. 08/224.

Morrison, A., White, L. (2005). “Crises and Capital Requirements in Banking.” The American Economic Review 95: 1548-1572.

Mortgage Bankers Association, 2009, “Press Release - National Delinquency Survey”, in: http://www.mbaa.org/NewsandMedia/PressCenter/71112.htm .

Reinhart C., Rogoff K. (2008) “Is the 2007 US Sub-Prime Financial Crisis So Different? An International Historical Comparison.” American Economic Review 98: 339-344.

Reinhart C., Rogoff K. (2009). “The Aftermath of Financial Crises.” American Economic Review 99: 466-472.

Shin, H. (2009). “Reflections on Northern Rock: the bank run that heralded the global financial crisis.” Journal of Economic Perspectives 23: 101-119.

Taylor, J. (2009). “The Financial Crisis and the Policy Responses: An Empirical Analysis of What Went Wrong.” NBER Working Paper No. w14631.

Taylor, J., Williams, J. (2008). “A black swan in the money market.” American Economic Journal: Macroeconomics 1: 58–83.

Williamson, S. (1988), Liquidity, Banking, and Bank Failures, in: International Economic Review 29, 25-43.