MASTER THESIS

BANK-BASED & MARKET-BASED FINANCIAL SYSTEMS AND FINANCIAL STABILITY

- Perspectives on the European Capital Markets Union

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Executive Summary

The Capital Markets Union was initiated in 2015 by the European commission with the aim to *"broaden the sources of financing in Europe towards nonbanking financing by giving a stronger role to capital markets"* (The European Commission, 2015a, p. 14). In the words of literature, the Capital Markets Union is pushing Europe's financial structure from a bank-based towards are more market-based one.

Through a generally deductive approach, this paper aims to extend the academic discussion where it left off and by doing so supporting the Capital Markets Union debate regarding whether market-based financing leads to a greater degree of financial stability. This is done by investigating whether a bank-based or a market-based financial structure leads to more financial stability. So forth literature investigates the efficiency of each of the two financial structures in the intermediation of savings to investments and the effect of financial structure on growth. Only a subset of literature has touched upon financial structures' effect on financial stability and no common conclusion on this topic has been found to date.

In order to determine how bank-based and market-based systems affect financial stability, this paper applies the old bank-market dichotomy in econometrically analyzing whether a bank-market ratio affects financial stability, the latter proxied by The European Central Banks' Composite Indicator of Systemic Stress and the St. Louis Financial Stress Index. An unbalanced panel of 17 countries, including USA and 16 European countries, ranging from 2002-2013 is modelled using panel data with fixed effects. In line with literature a subset of control variables are added to capture other variances affecting the dependent variable.

While the results of the paper does not suggest that either market-based or bank-based systems are in general more associated with financial stress, the results suggest that market-based structures seem to provide a greater degree of financial stability during financial crises compared to bank-based. Thus, after all, from a financial stability point of view, the results obtained seem to indicate that market-based structures seem advantageous. Even though the results are subject to several data and methodology consequences, such as limited sample size, it raises fundamental questions to existing literature, provides support to the Capital Market Union and provides a point of departure for further research.

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1. Introduction and Research Approach

1.1 Introduction

"*Few things matter more to society than economic growth and stability; yet few issues are more controversial*" (Stiglitz et al., 2006)

In the literature, there is a century old policy debate whether bank-based or market-based financial systems are better for promoting long-run economic growth, where a country is defined as bank-based or market-based depending on the relative importance of banks and markets in channeling savings into investments (Demirgüç-Kunt & Levine, 1999; Gambacorta, Yang, & Tsatsaronis, 2014; Langfield & Pagano, 2016a; Levine, 2002). For years, various researchers have tried to determine if one system is more advantageous in relation to growth, studying especially the efficiency of the two financial systems' intermediation of saving to investment. Financial structure's impact on financial stability, however, remains little explored.

The Capital Markets Union (CMU), a project kicked off end January 2015 by the European Commission, is based on the observation that Europe's financial systems are mostly bank-based and were missing the spare tire of market finance during the recent banking crisis. More specifically, one of the objectives with the Capital Markets Union is to *"broaden the sources of financing in Europe towards nonbanking financing by giving a stronger role to capital markets"* (The European Commission, 2015a, p. 14). According to the European Union, increasing market-based financing in Europe is supposed to increase growth and financial stability (The European Commission, 2015a).

The last financial crisis has moved the financial sector and financial stability back to the top of policy agenda, and it has once again proven that when the financial system goes awry and fails, it can devastate the lives of many people. Thus, achieving and preserving financial stability is now a key policy objective in most societies.
The last financial crises started in the US, and critics have been blaming the American system – known as the archetype of a market-based financial system – for causing the financial crisis.

On the contrary, the American economy has managed to recover faster than the overall European economy after the financial crisis, with smaller losses in terms of GDP compared to the Euro-area (Gros, 2014).

As the aim of the Capital Markets Union is to increase market-based financing, it is accordingly relevant and interesting to re-enter the old debate about market-based and bank-based systems and connect the discussion on financial structure to that of financial stability. The aim of the paper is to answer the following research questions:

- *How does market-based and bank-based financial structures affect financial stability?*

With the Capital Markets Union's intension to increase market-based financing as point of depature, this paper aims at investigating if countries relying relatively more on banks or markets in terms of financing - in line with the literature on bank-based and market-based financial systems – seem to be more financially stable.
This paper aims at answering the research question and the associated hypotheses through panel data fixed effects regressions; The results hereof might in turn give an indication of if the establishment of the Capital Markets Union increases or decreases financial stability, leading to potential policy recommendations.
As the point of departure is the Capital Markets Union, this thesis also includes a discussion of if other elements might potentially influence financial stability than the fact that more market-based financing, in the form of equity and bonds, is advanced.

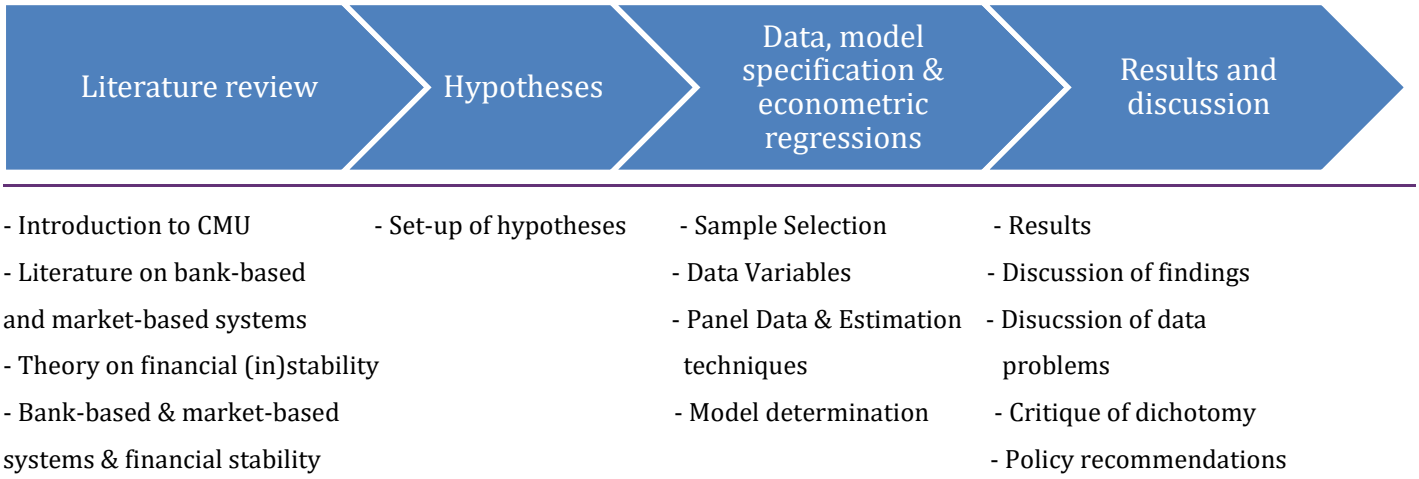
Additionally, this paper also hopes to contribute to literature as only a limited number of research papers has investigated market-based and bank based systems in relation to financial stability, in its narrow form, to date (Pagano & Langfield 2016).

The relevance and motivation for the topic was further enhanced after having the great possibility to discuss it with the very well-known professor within the area, professor Marco Pagano, whom confirmed his interest in and the relevance of the thesis at the conference on Financial Frictions at Copenhagen Business School.

1.2 Thesis Structure

An overview of the thesis structure can be seen in Figure 1.1 below.

Figure 1: Thesis Structure



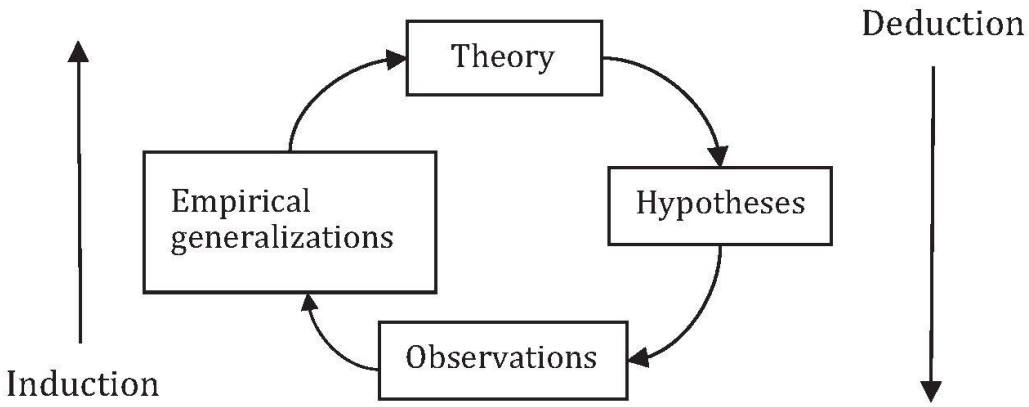
As the motivation and point of departure for the thesis is the Capital Markets Union, the objectives as well as motivation for the Capital Markets Union is shortly introduced together with the Action plan for the CMU and an overview of Europe's financial structure. Introduced next is literature on bank-based and market-based systems, including an introduction to the dichotomy, bank-market ratios in relevant countries, determinants of financial structure as well as theory on the comparative advantages of market-based and bank-based systems. Subsequently, definitions and theory on financial (in)stability are presented, followed by theory and empirical findings on bank-based and market-based systems in relation to financial stability. This theory, in turn, leads to the establishment of hypotheses. Subsequently, this paper moves forward by describing the sample, the data variables, panel data and estimations techniques. After a specification of the final regression model, the paper continues to test its research questions. Discussion of the results and findings, the validity of these, data problems, criqitue of the bank-market dichotomy and policy recommendations conclude the thesis.

1.3 Research Approach

To a large extent, the research approach of this paper can be characterized as deductive. The reason for this is the fact that the research is structured in a logical and linear order, where hypothesis are set up based on a theoretical litetature review (Saunders, Lewis, & Thornhill, 2009). In line with this, theory has also guided the data collection as well as the set-up of the statistical analysis.

In addition, this thesis seeks to establish generalizations on market-based and bank-based systems in relation to financial stability, at least in the sense that statistics allow generalizations to be made. In line with this, the nature of the research is quantitative.

Figure 2: Wheel of Science



Source: Wallace (1971)

Despite the fact that theory guides the establishment of the hypotheses, theory is not able to set-up clear-cut hypotheses on financial structure (market-based and bank-based systems) in relation to financial stability. Thus, besides the level of knowledge in the thesis being explanatory, as it tries to establish the relationship between financial structure and financial stability, it can to some extent be argued to be exploratory as well. More specifically, the research can be argued to be explanatory as theories already exist on bank-based and market-based systems as well as financial stability; exploratory because few studies have actually been conducted combining those areas, thus establishing clear-cut relationahips.

Despite the fact that the thesis is structured in a sequential order, as seen in figure 1, constant inflow of new information and insights on the topic and on the process in general create a

more iterative process. In this iterative process, theory is revisited, which is fitted to new information, from which fitted hypothesis then can be derived (Saunders et al., 2009). In order to establish robustness in findings, adding legitimacy to a final validation or rejection of hypothesis, such a process is necessary.
Consequently – and in line with the "Wheel of Science" – the research approach allows features from the inductive approach, as new understandings obtained while working on the topic or new observations discovered whilst working with the data call for a revisit of the original set-up of hypothesis.

1.4 Limitations

Financial systems are becoming increasingly complex and intertwined, and it is not an easy job to grasp all of this complexity. Using the old bank-based and market-based dichotomy allows one to simplify a complex world enabling one to investigate the area at a level where comparative analyses between countries are feasible.
As both financial systems and financial stability are complex topics, and based on the fact that all this complexity is difficult to comprehend in *one* paper, this paper is careful in establishing definite answers with regards to causality and particularities within financial systems and its influence on financial stability. *"Essentially, all models are wrong, but some are useful"* (Box & Wilson, 1951). For an overview and elaboration of limitations of the use of the bank-based and market-based dichotomy, see section 8.3.

Despite the fact that the Capital Markets Union also includes a focus on financial regulations, analyzing specific financial regulations as well as their effects on financial stability is out of this thesis' scope.

2. Literature Review

2.1 Capital Markets Union

The establishement of the European Capital Markets Union drives the motivation for looking into whether there is a difference between bank-based and market-based financial systems when it comes to financial stability as The Capital Markets Union aims at enhancing market-based financing.

Consequently, this section briefly describes the objectives of the Capital Market Union, as well as the European Commission's for its establishment.

2.2 The Objectives of the Capital Markets Union

In the end of January 2015, the European Commission kicked off its project to create a Capital Markets Union (CMU) for all of the 28 Member States. In September 2015, the Commission adopted an action plan setting out a list of key measures to achieve this.
The European Commission has prioritized to boost jobs, growth and investment across the EU and the Capital Markets Union is seen as an important element in order to support these goals for the long term (The European Commission, 2015c).

As the name indicates, the Capital Markets Union is an attempt to mobilize capital by establishing a genuine single capital market in the EU, where investors can invest their funds and businesses can raise funds, irrespective of their location (The European Commission, 2015a).
In the Economic Analysis of the CMU accompanying the action plan, three objectives of the CMU are outlined. The first objective is to *"broaden the sources of financing in Europe towards nonbanking financing by giving a stronger role to capital markets",* offering borrowers and investors a broader set of financial instruments to meet their needs (The European Commission, 2015a, p. 14).
The second objective is to "*deepen the single financial market for financial services"*, making the capital markets deeper, more liquid and competitive (The European Commission, 2015a, p. 14). Third, according to the Commission the CMU will help *"promote growth and financial stability".* According to the Commission, this will be done by facilitating companies' access to finance – especially SMEs –supporting growth and creation of jobs. Simultaneously, by promoting more diversified funding channels to the economy, according to the Commission the CMU will help "*address possible risks stemming from the over-reliance on bank lending and intermediation in the financial system"* (The European Commission, 2015a, p. 14).This diversifying of risk, in turn, is believed to make the whole system more stable.

2.3 Motivation for Capital Markets Union

Compared to other parts of the world, capital market based financing in Europe is relatively underdeveloped. The commission emphasizes that compared to other jurisdictions, European "*equity, debt and other markets play a smaller role in financing growth and European businesses remain heaily reliant on banks"* (The European Commission, 2015c, p. 2). This causes the economies to be vulnerable to a tightening of bank lending as under the financial crisis (European Commission, 2015a). These shortcomings of the European Union's financial system revealed by the financial crisis have been hindering economic growth and holding back recovery (European Commission, 2015a).

When illustrating why the EU should expand market-based financing, the Commission outlines the fact that the European economy is as big as the American one, however the equity markets are less than half the size, and its debt markets are less than a third. Especially compared to the US, medium-sized companies in the EU receive five times less funding from capital markets than they do in the US. In many countries, medium-sized companies are supposedly the engines of growth.

In addition to to comparing equity and bond markets with the US, the Commission (2015b) further emphasizes if European venture capital markets were as deep as the American ones, $90 billion of funds would have been available to finance companies between 2008 and 2013. Furthermore, the Commission points to the fact that capital markets remain fragmented and are typically organized on national lines. Additionally, financial market integration across the EU has declined since the 2008 crisis, European investment levels are well below their historical norm and European capital markets are less competitive at the global level (The European Commission, 2015c). An improvement of these factors is another aim of the Capital Markets Union.

The Commission makes the case that "*if the EU financial system was more diversified and had a larger share of funding channeled through capital markets, this should ultimately lead to a wider choice of financial instruments for the benefit of both enterprises and investors and a lower cost of raising capital, notably for SMEs, and increase the attractiveness of Europe as a place to invest. The EU economy could move towards a higher growth path and be more resilient to economic shocks"* (The European Commission, 2015a, p. 9).

2.4 Action Plan

The Action Plan sets out the actions that will be taken over the next year to ensure the building blocks of the CMU are in place by 2019.

According to Commission, there is no single measure that will deliver a Capital Markets Union. Instead, there will be a range of steps whose impact will cumulatively be significant, even though some initiatives individually are modest (The European Commission, 2015c). The action plan includes 33 actions and associated measures, of which some are early actions already put in place while others are scheduled for late 2016 or 2017.

The preparation of the proposed actions have already been or will be subject to appropriate consultation and impact assessment, and in general, the building of the Capital Markets Union takes a bottom-up approach where barriers are identified along the way and are being knocked down one by one.

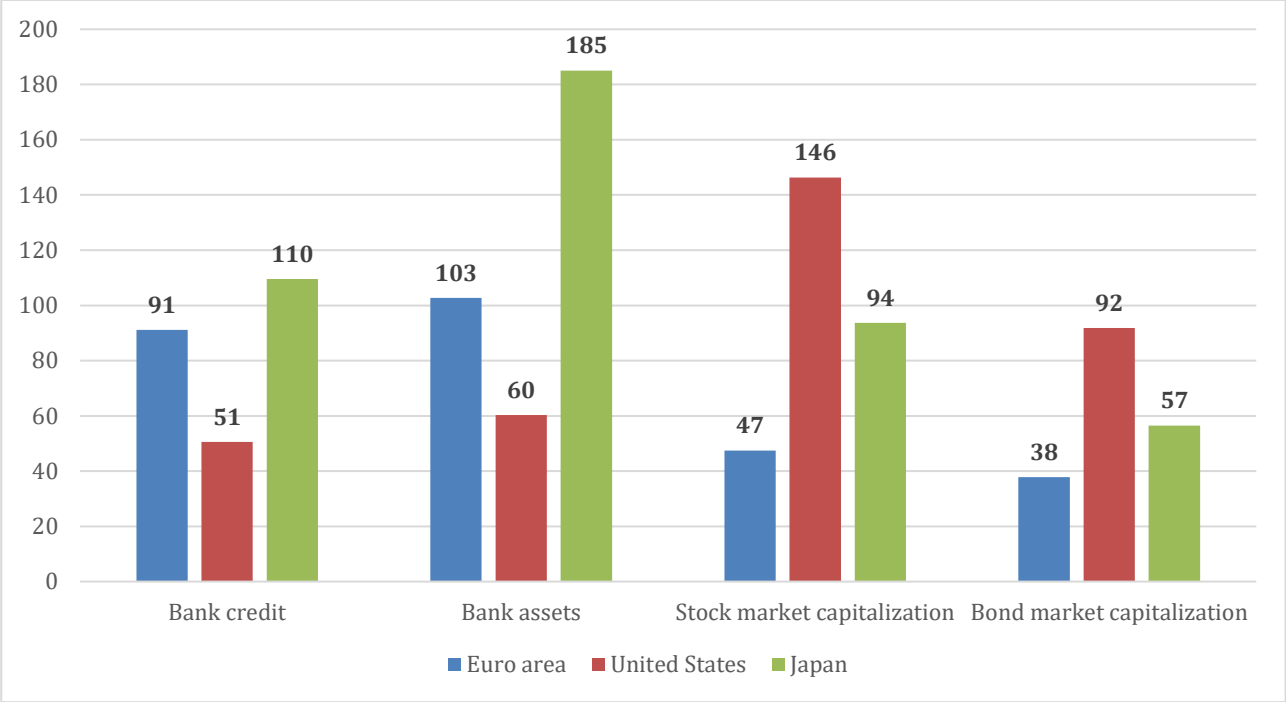
Some of the actions set out by the European Commission (2015c) that will enhance equity and debt finance, especially for smaller companies, are the following:

- Modernize the Prospectus Directive to make it less costly for businesses to raise funds publicly. In line with this, the Commission also want to review regulatory barriers to small firms listing on equity and debt markets (European Commission, 2015a).
- Launch a package of measures to support venture capital and equity financing in the EU. This includes catalyzing private investment using EU resources through pan-European funds-of-funds, regulatory reform, and the promotion of best practice on tax incentives.
- Promote innovative forms of business financing, including crowd-funding, private placement and loan-orginating funds.
- Building sustainable securitisation.

2.5 Europe's Financial Structure in Perspective

The purpose of this section is to shortly explore to which extent equity and debt play a smaller role in financing in Europe compared to the US and Japan, and likewise to understand to which extent Europe is more reliant on banks in comparison.

Figure 3: Total bank credit, bank assets and capital markets (% of GDP), 2014



Source: World Bank, Global Financial Development Database (2016)
Note: Bond market capitalization is defined as private bond market capitalization (Čihák et al., 2012)
Note: For more specific definitions, see appendix 1.8.
Note: Data on bond market capitalization is from 2012

By the graph above, it can be seen that the size of the Euro-area's stock and private bond market capitalization is considerably lower compared to its counterparts in the US and Japan. More specifically, total stock market capitalization is three times larger (in % of GDP) in the US in comparison to in the Euro-area, and is double the size in Japan. Furthermore, in comparison to the Euro-area private bond market capitalization is more than double the size in the US and 1,5 times bigger in Japan.

In contrast, the role banks play in Europe and Japan can be seen to be quite extensive in compared to the US. More specifically, while in the US total bank assets and bank credit

constitute 60 % and 51 % of GDP, respectively, in the Euro-area, they constitute 103 % and 91 %, respectively. In Japan, the reliance on banks is even more extensive.

3. Financial Structures & the Bank-Based and Market-Based Dichotomy

Next, this paper introduces the bank-based and market-based dichotomy and presents so-forth literature on this theory.

"*The financial structure of an economy is the set of institutions that channel resources from savers to investors, allocate them across alternative uses, and enable investors to share risks and diversify their portfolios. These functions can be performed by capital markets (such as bond and stock markets) or by financial intermediaries (such as banks) that match savers and borrowers independently of markets"* (Langfield & Pagano, 2016b).

In the economic literature, national financial systems or structures have stereotypically been classified in terms of the significance of bank-based versus market-based finance finance (Allen & Gale, 2000; Ergungor, 2008; Levine, 2002; Schmukler & Vesperoni, 2001).
This distinction is well recognized in the literature (Allard & Blavy, 2011) and the bank-based versus market-based dichotomy has been extensively used and debated over the last century when comparing financial structures across countries, focusing especially on studying the efficiency of the different financial systems in the intermediation between saving and investment (Allen, 2004; Demirgüç-Kunt & Levine, 1999; Langfield & Pagano, 2016a).
Demirgüc-Kunt & Levine (1999) claim that in order 'to analyse financial structure, we *must* classify countries as either market-based or bank-based' (p. 2, emphasis added).[1]

[1] While Allen & Gale (2000) and Demirguc-Kunt and Levine (2001), focusing on the banks vs. markets dichotomy, are key references in relation to financial systems, other theories exist explaining financial structures. These can be grouped into "type of services provided", "interactions among services", and "the role of international factors". For an in-depth understanding of these see (Claessens, 2016)

3.1 An introduction to bank-based vs. market-based structures

The United States and Germany are often seen as two the extremes, representing the market-based and bank-based system, respectively. Demirguc-Kunt & Levine (1999) has greatly contributed to the comparison of the two systems and has established the following view:

"In bank-based financial systems such as Germany and Japan, banks play a leading role in mobilizing savings, allocating capital, overseeing the investment decisions of corporate managers, and in providing risk management vehicles. In market-based financial systems, such as England and the United States, securities markets share center stage with banks in terms of getting society's savings to firms, exerting corporate control, and easing risk management" (Demirgüç-Kunt & Levine, 1999, p. 1).

In financial structures described as bank-based, surplus funds from savers are channeled to entities short of funds (e.g. households, companies and governments) through financial intermediaries in the form of banks. Banks perform this intermediation mostly on their balance sheets, taking in savings typically as deposits and providing funding primarily in the form of loans (Gambacorta et al., 2014). On the contrary, in market-based finance, borrowers mainly obtain funds directly from lenders by issuing securities or financial instruments in financial markets (stock and bonds markets). Markets serve as a forum where debt and equity securities are issued and traded, and financial markets are the main channels of finance in the economy.

Obviously, all financial systems combine bank-based and market-based intermediation. Consequently, whether financial structures are market-based or bank-based is not a binary question, but a variable one where one of the two systems may be more dominant than the other (Gambacorta et al., 2014).

Even though the market-based and bank-based classification of financial systems across countries is extensively used, there is no direct measure of the intermediation services that banks and markets provide that allows straightforward comparisons across countries. Consequently, empirical analysis of the topic relies on indicators proxying different aspects of the two intermediation channels (Beck, Demirgüc-Kunt, & Levine, 2010; Gambacorta et al., 2014; Langfield & Pagano, 2016a; Levine, 2002). Typically, literature measures financial structure by the size of the banking sector relative to the size of equity and bond markets. As a

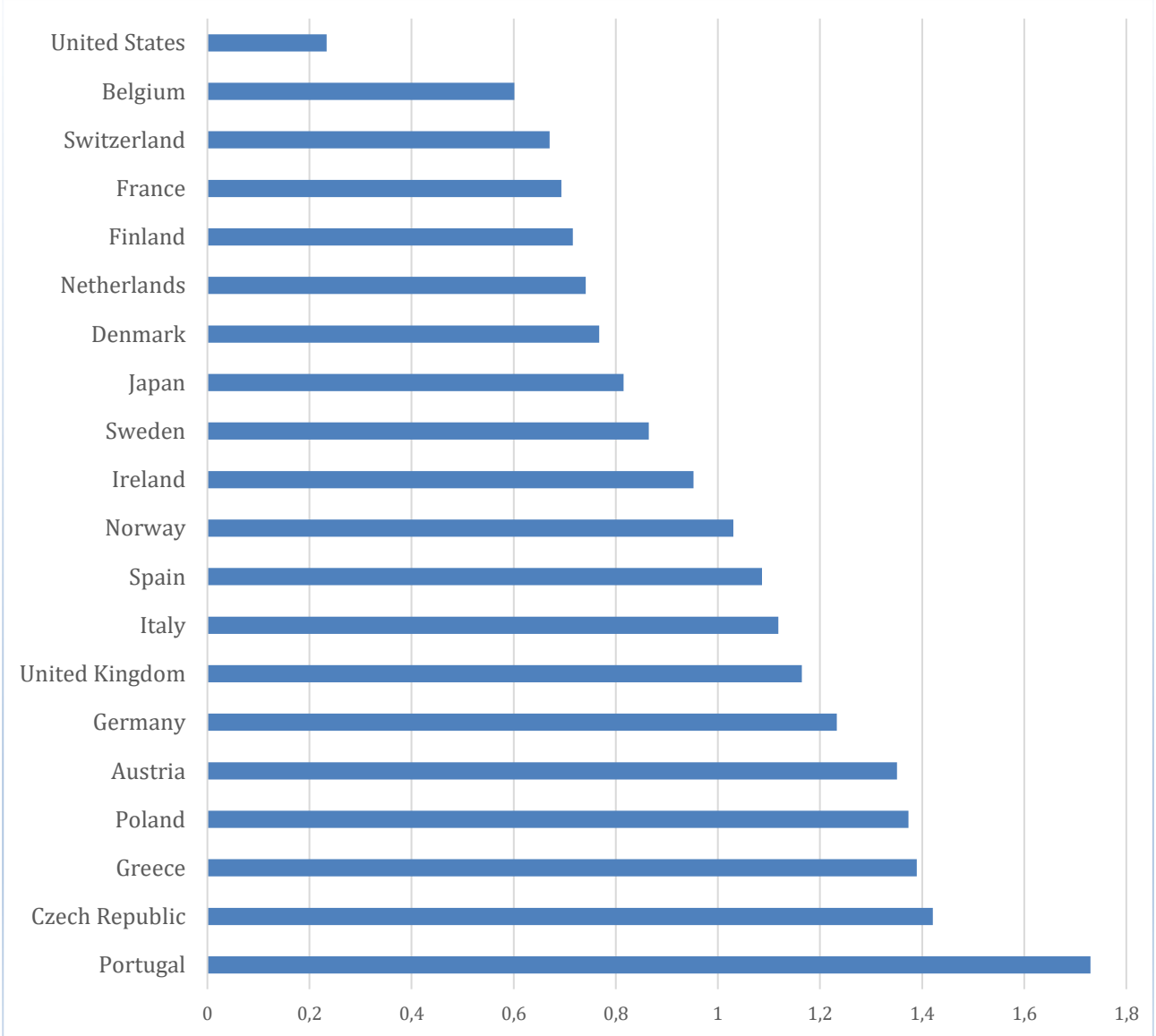
complementary measure of financial structure, one can look into domestic non-financial firm's sources of external funding in order to gauge their reliance on banks (loans) and equity and bond markets (Pagano, 2016b).

3.2 Bank-market ratios

Literature examining and comparing bank-based and market-based countries differ in their approach. They either classify a country's financial structure as bank-based or market-based depending on if its bank assets to GDP ratio is above or below median (Gambacorta et al., 2014). Otherwise, a country is classified as market-based when funding to the non-financial private sector from market sources exceeds funding from banks (Allard & Blavy, 2011). Alternative, a bank-market ratio is constructed, enabling one to assess the implications of the relative importance between banks and markets (Gambacorta et al., 2014; Langfield & Pagano, 2016a; Owen, Denizer, & Iyigun, 2000).
As the last approach seems more accurate – reflecting the fact that financial system is a combination of the two intermediation forms – this approach is applied in this thesis.

Below, the bank-market ratios of various European countries, including countries outside the EU, as well the US and Japan are presented.
Obviously, the US (often pointed out as the archetype of the market-based system) has the smallest bank-market ratio, Germany (often pointed out as the archetype of a bank-based system) has quite a large bank-market ratio in comparison (Allen & Gale, 2000).

Figure 4: Bank-Market raio 2000-2013 (average)
(bank credit divided by stock and bond capitalization)



Source: World Bank, Global Financial Development Database (2016)

Notes: The bank-market ratio is defined as total bank credit to stock and private bond market capitalization (Čihák et al., 2012)

Notes: For more specific definitions, see appendix 1.8.

Despite the fact that Europe is on average characterized as bank-based, it is worth noticing that the bank-market ratios across Europe varies.

Based on the fact that Japan has been known as a bank-based country, its relative placement on the above can be argued to be surprising. However, as can be seen in section 2.5 Japan still heavily relies on bank financing. Its placement might to some extent be explained by the relatively small role equity and bond financing plays in many of the European countries.
UK's bank-market ratio can be argued to be surprising, as it traditionally associated with large capital markets (Demirgüç-Kunt & Levine, 1999). However, despite the fact that its stock market capitalization is the 3rd largest of the countries included (after the US and Switzerland) it is also characterized by a large size of bank credit.

Before looking into the relative advantages of market-based and bank-based funding structures, the next section looks into determinants of financial structures.

3.3 Determinants of financial structure

In line with investigating whether a bank- or market-based financial structure provides most financial stability, this paper takes a step back to look at the the causes of different countries having different financial structures. Examining these causes is interesting, as they might be worth keeping in mind if evidence finds one financial structure to be more favourable when it comes to financial stability.
Accordingly, next literature on what influences countries' financial structure is introduced.

According to Allen & Gale (2000), financial structure should optimally reflect the comparative advantages of banks and capital markes in mitigating financial frictions. Thus, financial structures should develop endogenously as the most efficient institutional arragenemtents to supply external funding in the presence of incomplete markets.
In addition, legal institutions might influence financial structure as well as differences in financial structure might reflect the sectoral composition of output.

According to literature, banks thrive when contract enforcement is weak – which is more widespread in civil law countries with inefficient judiciaries compared to common law countries. To overcome enforcement problems banks demand collateral from borrowers and consequently, economies with an abundance of tangible and pledgeable collateral are therefore amenable to banking (Langfield & Pagano, 2016b). By contrast, legal frameworks

originating in the common law tradition tend to offer higher protection to holders of equity and debt securities, with minority shareholders having more tools to protect themselfes from expropritation by creditors, larger shareholders or management. Consequently, market-based finance is often more widespread in common law countries (Gambacorta et al., 2014).
In addition to banks thriving in sectors with tangible, transferable or plegdeable capital (such as agriculture or construction), banks also have a comparative advantage when economies consist of small and opaque firms. This is due to the fact that banks are able to acquire information about their borrower from a sustained borrower-lender relationship, and because of the fixed costs involved in tapping capital markets (Langfield & Pagano, 2016b). By contrast, sectors that to a large extent rely on human capital (e.g. professional service) will tend to rely more on bonds or equity (Gambacorta et al., 2014).

Despite the above, Europe's financial structure has become more bank-based between the late 1990s and the early 2000s. This has taken place simultatenously with improvements in the strength of political institutions and quality of legal enforcement, and with a relative decline in industries that are capital-intensive (Langfield & Pagano, 2016b). An explanation for this is the fact that financial structure is also influenced by public policy. For example, the Glass-Steagall Act which separated commercial and investment banking and state restrictions, confining commercial banks to their home states (constraining their lending capacity) influenced the development of bonds and equity markets in the US (The European Commission, 2015a). In turn, European governments have nurtured the birth and growth of large universal banks acting as 'national champions', and have been very supportive of banks, both in the form of bailout guarantees and regulatory forbearance (Langfield & Pagano, 2016b).

In addition to the above, it has been suggested that different historical starting conditions might exogenously influence financial structures. For example, the need to attract foreign investors to fund high US public debt in the early 19th century seem to have fostered the development of securities market early on, while prior to the industrialization, merchant banks had an important role in financing crossborder trade in Europe and were established financial instituions (The European Commission, 2015a).

"*While these factors limit the scope for the EU financial structure to converge to the US financial structure, they must not mean that the contribution of capital markets to economic activity has no potential todevelop, especially when legal determinants are made more supportive to market funding. In the end, legal, economic and financial structures are mutually dependent on each other"* (The European Commission, 2015a, p. 25). Furthermore, according to Langfield & Pagano (2016b), Europe's bank-based financial structure has to a large extent arisen due to past policies and politcal attitudes. Consequently, a substantial and long-lasting rebalancing of Europe's financial structure can only be achived with appropriate reforms and changes in political attitudes more specifically by reducing regulatory favouritism towards banks and supporting the development of securities markets as an alternative source of external funding. The Capital Markets Union can be argued to be an example hereof.

3.4 Comparative Advantages of Market-based versus Bank-based Systems

This section presents some of the arguments raised by the literature on bank- and market-based economies, typically studying the efficiency of the different forms of intermediation in the intermediation of savings to investments. Thus, this section theoretically compares the relative advantages (and disadvantages) of market-based and bank-based systems in general, as these are important in order to better understand each system, also in the later discussion in relation to financial stability.

While a wide range of different systems are observed in practice, the salient features of the two kinds of systems will here be sketched. As pointed out by Rajan & Zingales (2001 p. 472): "*Like all sketches, this one has elements of caricature, but this is the price we have to pay to avoid being distracted by the details".*

Theoretical Arguments

In order to get an overview of the theory comparing bank-based and market-based systems, a categorization of the theory is useful. Thus, this paper follows Beck's (2015) recent categorization, focusing on information production, corporate governance and risk diversification

Information Production

With no financial frictions, intermediaries (banks) have no comparative advantage in comparison to financial markets (Langfield & Pagano, 2016b). "*However, the real world is characterized by transaction costs owing to asymmetric information between users and providers of funds and to limited enforcement of contracts. In the presence of these frictions, comparative advantages can emerge: compared with markets, a financial structure dominated by banks performing direct intermediation can mitigate frictions – but in come cases also exacerbate them"* (Langfield & Pagano, 2016b, p. 1).

A central reason for the importance of banks is assymetric information. Specifically, in financial markets, one party often does not know enough about the other party to make accurate decisions (Mishkin, 2004). This information asymmetry creates problems in the financial systems both before the transaction (adverse selection) and after the transaction (moral hazard). Banks are likely to have a comparative advantage in mitigating these financial frictions, as they diminish adverse selection through an *ex ante* screening of borrowers, while they reduce moral hazard by monitoring firms' *ex port* investment decisions (Langfield & Pagano, 2016b).

Furthermore, banks perform intermediation through a close relationship with borrowers, opposite markets, which keep savers and investors at arm's length (Gambacorta et al., 2014). Consequently, banks are known for their relationship formation, through which they collect private information about their borrowers, further enhancing their ability to mitigate assymetric information problems.

Financial markets, on the other hand, produce public information, aggregated into prices. Based on the fact that information is going to be revealed by the market, no one has an incentive to engage in costly information-based activities and collect it, and thus markets are influenced by free-rider problems. [2] Instead, markets try to overcome agency problems by means of contract covenants and the courts (Gambacorta et al., 2014).

Those arguing for the superioty of bank-based financial systems in relation to information

[2] Pagano (2016b) has argued that capital markets to some extent might be able to overcome information asymmetries based on their symbiotic relationship with specialized financial institutions such as venture capital firms, investment banks and financial analysts.

production also highlight the economies of scale and scope in banks' information gathering and processing, another factor that improves banks' position to address agency problems between debtors and creditors compared to capital markets. Additionally, due to long-term relationships between firms and banks, firms have the opportunity to develop a reputation for good creditworthiness and ultimately access finance at a lower cost (The European Commission, 2015a). Often, banks' mitigation of asymmetric information problems is especially important for small firms or firms that do not have an established track record as creditworthy borrowers.

While the traditional view presented above thus find banks to be superior in relation to information production, Allen & Gale (2000) argue that these simple comparisons overlook the fact that markets and intermediaries may be dealing with different kinds of information. Thus, Allen & Gale (2000) underline the fact that what markets do well is to collect and aggregate *diverse* opinions.
The literature also points out that the superiority of banks in obtaining information about their borrowers is a mixed blessing, as banks' information advantage may prompt them to appropriate a share of their borrowes' profits and thus negatively affect borrowers' incentives to perform. This, however, can be mitigated if the borrower also has access to market-based funding which can provide competition and reduce banks' barganining power.

Corporate Governance
In relation to the above, institutions and markets also exercise corporate governance differently. Banks help improving corporate governance directly through loan covenants and influencing firm policy, while they can indirectly improve corporate governance by reducing the amount of free cash flows available to the management (Beck, 2011).
Financial markets can improve corporate governance by the threat of take-overs, through voting and by linking managements' payment to performance (Beck, 2011).

Proponents of the bank-based view has critized markets for creating a "myopic investor climate". More specifically, in liquid markets investors can inexpensively sell their shares resulting in the fact that they have fewer incentives to monitor managers rigorously (Demirgüç-Kunt & Levine, 1999).

Opposite, proponents of the market-based view claim points to the fact that banks might perform inefficient corporate governance if bank managers act in their own interest or exploit their information advantage.

Risk diversification

Financial institutions and markets also differ in their way to diversify risk. The standard view is that banks offer better intertemporal risk diversification tools, while markets are better at diversitying risk cross-sectionally (Beck, 2011).

Banks are critized for being less successful dealing with uncertainty and innovation as banks often have an inherent bias toward conservative investments (Allen & Gale, 2000). The reason for this is the fact that banks do not only intermediate between depositors and borrowers but also typically take up themselves a major part of the risk (The European Commission, 2015a). On the contrary, financial markets tend to be less conservative in the selection of the projects they finance as they bring investors and those in need of funding directly together, which transfers a higher share of the risk to investors (Allard & Blavy, 2011; The European Commission, 2015a).

An advantage typically pointed out about financial markets is that it allow investors to share risk. By dividing investment opportunities into numerous small-denomination securities, capital markets are able to create a diverse menu of investment options at higher or lower risk, and allocate these with matching investor types (European Commission, 2015a). Consequently, one can argue that markets are enabling additional investment that banks would not be ready to fund (European Commission, 2015a).

However, as pointed out by Allen & Gale (2000), (incomplete) markets do not do a very good job of dealing with nondiversifiable risk.

Allen & Gale (2000) argue that households in bank-oriented economies such as Japan, Germany and France hold more safe asets compared to equity. Consequently, they are exposed to relatively less risk. In contrast, in market-oriented economies like the US and UK, households hold a large part of their assets in equity. Thus, the households bear substantial amounts of market risks that can be associated with changes in the market value of assets (Allen & Gale, 2000) Consequently, it is argued that a bank-based financial system, where

reserves are acquired to provide intertemporal smoothing, can be superior under certain circumstances (Allen & Gale, 2000).

With regards to risk, however, banks have been critized for lacking customized hedging instruments and literature has argued that market-based economies tend to offer more sophisticated, flexible and tailor-made risk management solutions (Allard & Blavy, 2011). Proponents of market-based systems further critizie banks for having a pro-cyclical character of credit supply, and for engaging in zombie-lending[3] during financial crisis (Beck, 2015).

4. Financial Stability

4.1 Definition and meaning

"*It is extremely difficult even to define, and harder yet to measure, financial stability*;" (Goodhart & Tsomocos, 2012).

Even though financial stability has moved to the forefront of financial surveillance work done in central banks and financial institutions, there is no concensus on what exactly best decribes the state of financial stability. The difficulty of defining and measuring financial stability is partly explained by the relative infancy of the field, but is to a large extent caused by the interdependence and the complex interactions of different elements of the financial system among themselves and with the real economy. Additionally, it is complicated further by the time and cross-border dimensions of such interactions (Gadanecz & Jayaram, 2009). Consequently, there is no uniformly accepted definition of financial stability (Mohr & Wagner, 2011).

According to the European Central Bank (2015, p. 4) financial stability can be described "*as a condition in which the financial system – intermediaries, markets and market infrastructures – can withstand shocks without major disruption in financial intermediation and in the general supply of financial services".*

Andrew Crockett, formerly at the Bank of International Settlement in Basle, distinguishes between two types of stability: the stability of financial institutions and the stability of

[3] Banks may opt to roll over credit in an effort to postpone loss recognition (Gamacorta et al., 2014).

financial markets. Stability in the financial instutions means that the institutions – the banks, pension funds, the stock exchange, etc. – are able to meet their contractual obligations without interruption and without need for external support. Thus, the instituions are stable when they are able to respect contracts (Blejer, n.d.). However, institutional stability is not enough, as there could be lack of financial market stability despite institutional stability. Thus, the second type of stability are financial market stability – or stability of asset prices. This, Blejer argues, is the one *"that we are sometimes more concerned with".* Most often, if there is no stability in financial markets, assets prices will not reflect the fundaments and consequently fluctuate without any rational explanation (Blejer, n.d.).

The literature has sometimes argued, that answering the question of what is financial stability, is best answered by considering its absence. According to Chant et al (2003 p. 3) financial instability "*refers to conditions in financial markets that harm, or threathen to harm, an economy's performance through their impact on the working of the financial system. It can arise from shocks that originate within the financial system being transmitted throughout that system, or from the transmission of shocks that originate elsewhere by way of the financial system".*

Based on the fact that financial stability is difficult to measure, this paper instead measures financial stress as well as the total absence of financial stability, i.e. financial crises.

4.2 Measurement

To measure financial (in)stability, the literature has in general relied on three broad categories of indicators (Mohr & Wagner, 2011). The first strand of literature has used banking crisis indicators in order to identify if an economy experienced a crisis during a certain time period. In these studies, a dummy variable have been utilized in order to indicate whether or not a crisis has occurred (Mohr & Wagner, 2011). The second strand of empirical studies uses single variables as proxies for financial (in)stability, often focusing on balance sheet items from financial institutions as for example nonperforming loans (Mohr & Wagner, 2011). In relation to single variables as proxies for financial (in)stability, a common measure of financial (in)stability is the z-score, which compares buffers (capitalization and returns)

with risk (volatility of returns) in order to measure a banks' solcency risk (Cihak, Demirgüç-Kunt, Feyen, & Levine, 2012). However, the z-score has several limitations as a proxy for financial stability. First of all, z-scores are based purely on accounting data, meaning that the underlying accounting and auditing framework (and financial institutions ability to smooth out the reported data) influences the quality of the z-score as a proxy. Second of all, the z-score and other single variables look at each financial institution separately. Thus, they might be overlooking the risk that a default in one financial institution may result in loss to other financial institutions in the system risk (Cihak et al., 2012). That is, they might overlook systemic risk which showed to be important in the last financial crisis.
A third strand of literature uses composite indicators of financial stress; After having selected relevant variables, a single aggregate measure is calculated of the variables identified, typically as a weigthed average (Mohr & Wagner, 2011). These indicators often cover risk spreads, measures of market liquidity, the foreign exchange and equity market as well as the banking sector. Thus, these indeces provides a measure of stress in the financial system as a whole.

In this paper emphasis is put on Crockett's definition of financial stability, i.e. emphasis is put on measuring financial stability of both financial institutions *and* markets.
Thus – in line with Crocket's definition - this paper will use composite indicators of financial stress in order to measure instability. Composite indicators furthermore have the advantage of being able to measure stress continuously instead of only during extreme events, such as only banking crisis which increases the sample size (Gadanecz & Jayaram, 2009).

Obviously, the most widely evaluation criterion for these stress indicators are their performance in identifying well-known periods of financial stress, where an indicator is expected to increase sizeably in responsible to serious disruptions in the financial system (Hollo, Kremer, & Lo Duca, 2012). In addition, the stress indicators react on the following key features of financial stress: (i) increases in uncertainty about fundamental value of assets, (ii) increased uncertainty about the behavior of other investors, (iii) increased asymmetry of information, (iiii) decreased willingness to hold risky and/or illiquid assets (Hollo et al., 2012).

4.3 The causes of financial instability

In order to examine if bank-based or market-based structures are more associated with financial stress, it is valuable to get an understanding of the causes of financial instability. Thus, this section shortly discusses the causes of financial instability outlined in literature.

When identifying indicators of financial instability, analyses are often based partly on theories about the origins and causes of financial crises (Dyrberg, 2000). This makes sense, as a financial crisis is defined as a period of extreme financial instability or stress (Sarlin, 2014). The theories about causes of financial stability are often based on actual financial crises, and thus one can argue might not be fully complete. However, certain common elements can be identified for many of the financial crises around the world, and it therefore makes sense to derive indicators of financial instability on the basis of general patterns (Dyrberg, 2000).

While financial crises takes various shapes and forms, they have some common elements. A financial crisis is often associated with one or more of the following phenomena: substantial changes in credit volume and asset prices; severe disruptions in financial intermediation and the supply of external financing to actors in the economy; large scale balance sheet problems (especially of financial intermediaries, but also companies, households and sovereigns); and large scale government support, typically in the form of liquidity support (Claessens & Kose, 2013). Thus, financial crises are often difficult to characterize using one single indicator, as they are typically multidimensional (Claessens & Kose, 2013).

While some of the factors driving crises has been identified in the literature, identifying the deeper causes of financial crises still is a challenge (Claessens & Kose, 2013).
Over the years, many theories have been developed regarding the underlying causes of crisis. While fundamental factors such as macroeconomic imbalances, internal or external shocks, are often observed in relation with financial crises, financial crises sometimes also appear to be caused by "irrational" factors. Among others, these include sudden runs on banks, contagion and spillovers among financial markets, credit crunches, emergence of asset busts, limits to arbitrage during times of stress, firesales.
As many factors can explain financial crisis, this section will only go into depth with selected theories most often used in the literature (Claessens & Kose, 2013; Dyrberg, 2000). These, can

be classified into “microeonomic” and “macroeconomic theories”.

Microeconomic theories:

Financial panic:

Financial panics occurs when a large number of customers of a bank withdraw their deposits simultatenoiusly due to concerns about the bank’s solvency. Traditionally, a bank grants loans to and receives deposits from the general liquid, thus transforming short-term liabilities into long-term assets. In order for customers to be able to withdraw their deposits as they require, the deposits must be kept liquid. As lending is less liquid, the bank has to use other assets to ensure that is has the needed liquidity to cover deposits and prevent runs on deposits (i.e. demand for substantial withdrawals all at the same time) (Dyrberg, 2000). If a large proportion of a bank’s deposit is withdrawn within a short period (a run on the bank), the bank may not be able to meet depositors’ withdrawal demands. As the bank cannot immediate realise its illiquid assets (loans) at nominal value, the bank can be forced to sell the illiquid assets at a lower price. Losses on selling the asset at lower prices can cause a bank to become insolvent (Dyrberg, 2000).

While the above describes a traditional bank run (retail runs), runs on wholesale funding played an important factor in the last financial crisis (Gertler, Kiyotaki, & Prestipino, 2016). More specifically, financial instituions are today increasingly financing themselves through wholesale markets in addition to deposits in order to ensure liquidity in the short term. As uncertainty increased in the financial crisis and market players became increasingly unsure about the health of other financial instituions, some financial instituions were not able get continuous funding via inter-bank or wholesale markets. This, has been characterized as a “modern bank run” (Rangvid Udvalget, 2013).

Assymetric information:

One of the famous economist who explains financial crises through agency theory is Mishkin (2004). According to Mishkin (2004), financial instability occurs when shocks to the financial system interfere with information flows - increasing adverse selection and moral hazard problems – which unables the financial system to do its job of effectively channeling funds to those with productive investment opportunities. With no access to financial funds, companies and individuals cut spending. This, in turn, results in a contraction of economic activity, which

might be quite severe ((Mishkin, 1997, 2000, 2004). Thus, Mishkin (2004) stresses the importance in agency theory in helping to understand financial instability, and uses agency theory when he describes why the following four factors are traditionally associated with financial instability: increases in interest rates, increases in uncertainty, a deterioration in bank balance sheets, and negative shocks to nonbank balance sheets such as stock market declines (Mishkin, 2004). Increases in interest rates raises financial instability, as with higher interest rates, good credit risks are less likely to borrow while bad credit risks are still willing to borrow. Because of the resulting increase in adverse selection, lenders will no longer want to make loans. This in turn causes a decline in lending, leading to a decline in investments and aggregate economic activity (Mishkin, 2004). Similarly, a dramatic increase in uncertainty (or increased asymmetry of information) in financial markets, makes it harder for lenders to screen good from bad credit risks. This also causes a decline in lending and aggregate economic activity, as the inability of lenders to solve the adverse selection problem makes them less willing to lend.

In addition to the above, increased uncertainty about fundamental value of assets and increased uncertainty about behavior of other investors have been emphasized to play a role in relation to financial stress (Hakkio & Keeton, 2009). Increased uncertainty about the fundamental values of assets leads to greater volatility in asset prices by causing investors to react more strongly to new information. Likewise, uncertainty about the behavior of others result in increased volatility of asset prices, as prices become more volatile when investors base their decisions on guesses about other investors' decision.

Macroeconomic theories:

Financial crises are often preceded by increases in asset prices and leverage buildups and greater risk-taking through rapid credit expensation, and thus many theories focusing on the causes of financial crises have recognized the importance of booms in asset and credit markets (Claessens & Kose, 2013).

Asset Price Booms, Credit Booms and Busts

Sharp increases in asset prices (or bubbles) often followed by crashes have been around for centuries, with a well-known example in form of the Dutch Tulip Mania dating back to 1634. Asset prices sometimes starts deviating from fundaments, and exhibit patterns that are

different from predictions of standard models with perfect financial markets.
Different models attempt to explain asset price bubbles, including models assuming "irrationality" on investors and herding among financial financial players and market sentiment. Some models employ that rational investors can explain bubbles without distortions, uncertainty, speculation, or bounded rationality (Claessens & Kose, 2013).. These models consider asset price bubbles as agents' "justified" expectations about future returns.
Credit booms can be triggered by various factors, including structural changes in markets and shocks, which could be changes in producitivy, economic policies and capital flows. Financial liberalization, innovation, accommodative monetary policies and sharp increases in international financial flows can amplify credit booms. The last financial crisis was indeed associated with associated with large capital inflows, rapid expansion of credit and sharp growth in house and other asset prices (Claessens & Kose, 2013).
There are two channels of which asset price busts affect banks' and other financial institutions' lending and investment decisions. In the case that borrowing is collateralized and the price of this collateral falls, the ability of firms to rely on assets as collateral for new loans weakens. In turn, this affects financial institutions' ability to extend new credit, which adversely affect investment (Claessens & Kose, 2013). Second, the prospect of larger price dislocations due to financial turmoil and to fire sales distorts financial institutions' decisions to lend or invest and consequently stock cash. The real economy is negatively affected through both channels (Claessens & Kose, 2013).
Busts following bubbles can initially be triggered by small shocks, for example a decline in asset prices due to fundamentals or sentiment.

Systemic Risk

After the last financial crisis, systemic risk has emerged as an important aspect in relation to financial stability and financial crises. Systemic risk represents the risk that an event at the company level could trigger severe instability or collapse an entire economy and has been defined as the *"risk of disruption to financial services that is caused by an impairment of all or parts of the financial system and has the potential to have serious negative consequences for the real economy"* (Caruana, 2010).
Central to systemic risk are the "three Cs": connectedness (interconnectedness), contagion, and correlation. Interconnnectedness refers to the phenomenon in which the failure of, or

large losses borne by, one firm provoke a chain reaction of failures by other financial institutions (Hal Scott, 2011). The networks of real exposures among banks consists of interbank lending and of those in wholesale and reail payment and settlement system (Sarlin, 2014).

Contagion refers the process whereby the failure of one instituion either causes the creditors of others to withdraw funding in a manner akin to a classic bank run, or instead starts a general panic leading markets to freeze. The behavior can also spread to short-term capital markets, which funds the complex and growing number of non-depository financial institutions (Hal Scott, 2014). Contagion is distinguished from other major causes of systemic instability in the financial system by propagating *indiscriminately* (Hal Scott, 2014). The collapse of Lehman Brothers is a known example of interconnectedness combined with contagion.

Correlation denotes the failure of multiple instituions because of correlations of asset prices that collapse due to an exogenous cause.

In addition to systemic risk, financial innovation and an increased complexity in products and markets are known for contributing to the last financial crises (Tombini, 2006). In addition, inadequate supervision and regulation has been blamed for contributing to the build-up of financial imbalances (Nier & Merrouche, 2010).

5. Bank-based and Market-based Systems and Financial Stability

This section outlines theory on bank- and market-based structures in relation to financial stability. Moreover, possible relationships between financial structure and financial stability are discussed based on the theory outlinining advantages about market-based and bank-based systems.

In addition, empirical findings on the topic are presented. As the literature has primarily focused on bank-based and market-based systems in relation to growth, the literature focusing on financial structure in relation to financial stability in its narrow sense is not very comprehensive. Thus, papers focusing on financial structure in relation to macroeconomic risk, growth volatility and business cycles are included too as these concepts are strongly correlated with financial instability.

Despite the fact that securitization and banks' reliance on wholesale funding – representing a cooperation between banks and markets – played a significant role in the last financial crisis, this section focuses less on cooperation and intertwinedness between the two intermediation forms and more on each form's distinguished characteristics, as this paper tries to identify if there is a *difference* between the two systems in relation to financial stability.

5.1 Theory

With regards to financial structure and stability, it is interesting to look into banks' and markets' comparative advantages in order to see how these might play a role with regards to financial stability.

Information production

In relation hereto, from a theoretical perspective, banks' comparative advantage is their ability to collect private information about their borrowers through repeated interaction, which enables them to reduce information assymtry and establish long-term relationships with customers. The collection of information and banks' closer relationship with customers might result in banks being able (and willing) to help borrowers facing temporary liquidity shortfalls, as banks are able to identify solvent borrowers (Langfield & Pagano, 2016a). In the traditional banking literature, it has been emphasized that banks have an interest in maintaining business with their borrowers, resulting in the fact that they are willing to smooth interest rate fluctuations for clients with which they maintain strong relationships (Berlin & Mester, 1998).

(Bolton et al (2013) have developed a model in which relationship banks due to their information gathering are able to provide loans for profitable firms during a crisis. When testing the model in the same paper, they present evidence of Italian relationship banks' continuing lending to solvent firms following the bankruptcy of Lehman Brothers.

Helping firms with temporary liquidity shortfalls possibly results in more financial stability as it might prevent otherwise stable firms from defaulting or as it might at least decrease the risk of default and uncertainty.

Corporate Governance

(Rajan & Zingales, 2001) argue that in market-based systems, transparency and disclosure are required in order to give investors the confidence to invest directly in particular furms. This greater transparency improves the ability of a system to withstand shocks. On the contrary, Rajan & Zingales (2001) argue that should a relationship-based system suffer adverse shocks, the flow of credit can quickly collapse as it is difficult for healthy intermediaries to easily replace failing intermediaries, due to the embedded relationships between the failing intermediaries and their clients.

Because financial markets tend to be less conservative than banks in the selection of the projects they are willing to finance, the range of sectors and firms with access to financing may be larger in market-based economies than in bank-based economies. This, in turn, may lead to greater risk-taking and thus more volatility (Allard & Blavy, 2011).

Risk diversification

As outlined in the section about comparative advantages about each system, markets are known for engaging in intra-temporal smoothing, whereas banks engage in intertemporal smoothing. Thus, in market-based systems asset price adjust as shocks materialize and the impact of the shock is distributed widely, whereas banks absorb shocks on their balance sheets (Claessens, 2016). The question is if banks are always able to absorb the shocks on their balance sheets? In line with this, one can ask if the distribution of shocks via temporal smoothing always decreases the shock by spreading the risk?.

As previously outlined, during a financial crisis banks may postpone necessary balance sheet restructuring and might engage in zombie lending, i.e. continuing to lend out in order to postpone loss regnotion (Gambacorta et al., 2014). In contrast to banks, capital market investors cannot afford to roll over credit in an effort to postpone loss recognition. In a financial crisis, therefore, systems that are more market-oriented may speed up the necessary deleveraging, thereby paving the way for a sustainable recovery (Gambacorta et al., 2014).

An important argument for capital markets contributing to financial stability also outlined in relation to the establishment of the Capital Markets Union, is the idea that capital markets might be superior due to the "spare tire" view. The spare tire view represents the idea that

securitity market financing can act as a stabilizing factor (spare tire) when the supply of bank credit contracts. Thus, if a financial crisis influences banks ability to lend and firms do not have an alternative source of financing, firms will suffer more than if the securities markets could instead provide external finance. In 1999, Alan Greenspan, then Chairman of the Federal Reserve System, argued that stock markets could mitigate the negative effects of banking crises, including greater unemployment (Levine, Lin, & Xie, 2016). In line with this "B*ecause of this substitution effect, financial structures with well-developed capital markets tend to be associated with less extreme fluctuations in the provision of external finance and therefore in aggregate output*" (Pagano & Langfield, 2016b).

In relation to the above, Phumiwasana (2003) among others, argues that the portfolio diversification concept from investment theory also can apply to financial structure diversification. According to him, a lack of financial structure diversification may increase economic instability, based on which he notes that the development of a market-based financial system would reduce the economic volatility more than a bank-based system alone. However, with greater market-based financial systems often comes greater interconnectedness (European Commission, 2015b). This greater interconnectedness can lead to higher asset price correlation, which in turn might reduce portfolio diversification for investors and possibly increase systemic risk (European Commission, 2015b).

Equity has been argued to offer the best trade-off between risk sharing and financial stability (The Bank of England, 2015). The reason for this is the fact that payments by liability holders can be adjusted according to needs, which is not the case for loans or bonds. Furthermore, based on the fact that banks' holding of equity instruments would be limited, the risk for financial instability in the core of the financial system might be reduced (The Bank of England, 2015).

Other theory: Booms, leverage, volatility

Banks have been greatly associated with asset and credit booms, as well as bank runs because of the maturity mismatch between banks' assets and liabilities.

Bank lending has been claimed to be highly cyclical, possibly due to banks' high leverage (Pagano & Langfield, 2016a). Pagano & Langfield (2016a) explains the cyclicality due to leverage as follows: Due to a rise in asset prices, the value of collateral and firm equity

increase, which in turns allow banks to expand credit. This, in turn feeds back into asset prices, which stimulies further credit expansion. The highly leveraged nature of banks amplifies this mechanism, because when asset prices increase, banks' own equity value increases. Consequently, loans can be expanded by a multiple of the gains on banks' equity while the leverage ratio is kept unchanged. Opposite, a drop in asset prices forces banks to deleverage, driven both by market and regulatory pressures. This deleveraging process at an aggregate level might cause a recessionaly pulse with further asset price declines and deleveraging.

Based on the above, it is argued that banks' high degree of leverage creates an amplification mechanism, amplifying the impact of asset price shocks on lending and economic activity (Langfield & Pagano, 2016a). Based on that, it is argued that one should expect economic activity to be more sensitive to asset price fluctuations in bank-based than in market-based structures.

Additionally, Langfield & Pagano (2016a) argue that banks' excessive risk-taking can have systemic consequences when many banks are engaged, as the values of their exposures are highly correlated. This in turn can lead to fire sales and economy-wide contagion. The magnitude of this is hypothezied to be larger in more bank-based economies, as bondholders and stockholders might absorb losses stemming from asset price drops without generating simulatenous deleveraging and spillover effects in the economy, as bondholders and stockholders are typically less leveraged than banks (Langfield & Pagano, 2016a).

The European Commission has pointed towards the fact, that "*A more market-based financial system, involving increased direct investor exposures to risk, could be more vulnerable to episodes of volatility",* as contagion can propagate across markets and financial instittuions through balance sheet and collateral channels in the event of a sudden repricing of risk (European Commisison, 2015a). In contrast to this, a well-capitalized banking system, benefitting from central bank liquidity, deposit protection schemes and high liquidity buffers, might be less exposed to these risks (European Comission, 2015a).

"*A higher exposure of financial market participants to volatility in market prices, for example, can feed into higher risk premia and thus lead to increases in the cost of capital for companies and financial losses for households"* (The European Commission, 2015a). Accordingly, it is argued that financial instability can adversely affect economic activity despite the fact that it

does not result in systemic shocks. “Herding behavior”, as outlined earlier might cause the sudden repricing of risk or even exacerbate volatility (Puhmiwasana, 2003).

In line with this, financial markets have traditionally been seen as excessively volatile, exposing investors to market risk, and has furthermore been critized for being vulnerable to speculative actions, which can drive volatility and cause financial instability (Khorasgani, 2011). Relatedly, critics of the Capital Markets Union points to market liquidity being “*complex, contingent and volatile”* (Gabor & Vestergaard, 2015).
Banks, on the other hand, has been under scrutiny and financial regulation has been heavily recalibrated over time in order to ensure that they are resilient to shocks.

However, on the other hand, it has become evident after the recent financial crisis that bank funding markets functioned as a key propagation mechanism in the crisis.
On the other hand, it was the large-scale default of market-based financial innovations, such as residential and commercial mortgage-based securities, that triggered the first wave of the last crises in the US. This was mostly due to the lack of transparency and assymetric information in relation to the asset quality of the underlying mortgages.

Before looking into empirical findings, the figure below gives a short recap of the arguments, connecting bank-based and market-based systems’ relative advantages and disadvantages with financial stability.

Figure 5: Relative advantages and disadvantages of bank-based and market-based systems in relation to Financial Stability

Financial Structure	***Pros***	***Cons***
Bank-based	*Relationship-feature (smooth interest rate shocks) on lending customers*	*Maturity mismatch between assets and liability and highly leveraged banks*
	Well-regulated	*Engaged in zombie-lending*
Market-based	*"Spare tire" effect and portfolio diversification*	*Vulnerable to volatility due to increased direct investor exposure to risk*
	Speed of necessary deleveraging and greater transparency	*Herding behavior more widespread*

5.2 Empirical findings

Langfield & Pagano hypothesize bank-based financial structures to feature higher systemic risk than market-based structures because of a greater build-up of risks during asset price booms and more pronounced deleveraging once asset prices drop substantially. Langfield & Pagano (2016a) construct a data set comprising systemic risk and information on total bank assets and stock and private bond market capitalization at country-level, in order to determine a country's bank-market ratio (i.e. the extent to which a country relies more on bank-based or market-based financing). In order to capture bank's contribution and exposure to systemic risk, they use the variable SRISK, which measures the euro-amount of equity capital that a bank would need to raise in the event that the broad stock market index falls by 40 % over 6 months (Langfield & Pagano, 2016a).
Their results suggest that an increase in a country's bank-market ratio, i.e. an increase in the size of the banking system relative to equity and private bond markets, is associated with more systemic risk, particularly during housing market crisis.

In their paper on finance and macroeconomic volatility, Owen et al., (2000) find that the relative importance of banks in the financial system is important in explaining consumption and investment volatility. Their results suggest that the risk management and information processing provided by banks may be particularly important in reducing consumption and investment volatility, as banks may be in the best position to reduce information asymmetries

and develop longer-term relationships with borrowers, which in turns reduce the volatility of investment.

In support of banks being able of cushioning financial shocks based on their relationships with borrowers, Gambacorta et al. (2014) find that during "normal" downturns, i.e. when there is no financial crisis, economies with bank-based systems appear more resilient. More specifically, Gambacorta et al. (2014), found bank-based systems to register virtually no GDP loss on average in times of "normal" downturns with no financial crisis. By contrast, in these same episodes, countries with market-based systems experienced an average output loss of more than 3 %. Thus, these results support the idea that when banks are not themselves under strain, they help their clients absorb economic shocks (Gambocorta et al, 2014).
On the other hand, Gambocarta et. al (2014) find that when a recession coincide with a financial crisis, bank-based countries tend to be more severly hit than market-based countries. More specficially, in this case, total real GDP loss are found to be 12.5 % of GDP in bank-based countries while it is found to be 4.2 % of GDP in market-based.

Allard & Blavy (2011) investigate financial structure's impact on business cycles and economic recoveries, having the hypothesis that whether an economy is bank-based or market-based matters for its ability to recover from economic crises. They study a sample of 84 economic crises in 17 advanced economies, testing whether recoveries are significantly different between countries categorized as bank-based or market-based, classified according to the relative weight of market financing (stocks and bonds) and bank lending in the financing of the non-financial private sector. Their paper suggest that, among advanced countries, market-based economies recover significantly faster than bank-based economies.

Phumiwasana (2003) empirically investigated relationships between financial structure (bank-based or market-based economies) in relation to growth volatility. Using panel regressions, he found evidence that bank-based financial systems increase the growth volatility among developed countries, while bank-based systems decrease growth volatility among developing countries.

The International Monetary Fund (2006) find that in more arm's length (more market-based) systems, households appear to be more vulnerable to rising interest rates and swings in asset prices, implying larger effects on demand from major asset price booms and busts. The International Monetary Fund (2006) explains this by the fact that under a more arm's length system, households are able to access a larger amount of financing.
Focusing at the corporate sector, the International Monetary Fund (2006) founds that cyclical changes in investment seem to be less severe in more relationship-based (bank-based) systems, possibly because these systems provide more cash flow support to companies in case of temporary changes in demand.

5.3 Hypotheses

Based on the theory and empirical evidence above, it becomes evident that the theoretical literature has not yet established a clear-cut prediction on the relationship between financial structure and financial stability, possibly due to the complexity of both.

However, drawing mainly upon the traditional features of banking, namely its willingness to extend credit and smooth the impact of shocks on lending relationships, which possibly decreases uncertainty, it seems reasonable to hypothesize bank-based structures to inhibit less financial stress in general.
In line with this, a market-based financial system, which involves increased direct investor exposures to risk, might be more vulnerable to risk and might react stronger to asset price fluctuations.

On the other hand, during a financial crisis market-based financial systems might prove more financially stable due to the "spare tire" effect.
Furthermore, according to Pagano (2016a) banks' high leverage creates a mechanism that amplifies the impact of asset price shocks on lending and economic activity. Thus, due to a greater build-up of risks during asset price booms and more pronounced deleveraging once asset prices drop, financial instability is hypothesized to be worse in bank-based financial systems during financial crises.

Based on the above, it seems reasonable to set up two hypotheses in relation to financial structure and financial stability as literature seem to suggest that whether there is a financial crisis or not might possibly make a diffence:

Hypothesis 1: Bank-based financial systems are in general more financially stable compared to market-based financial systems

Hypothesis 2: Market-based financial systems are more financially stable compared to bank-based financial systems during a financial crises.

6. Methodology, Data Variables and Panel Data & Estimation Techniques

6.1 Sample Selection

Initially, this paper aimed at investigating all countries in the European Union as well as the US and Japan, as the European countries are the main countries of interest, while the US is the archetype of a market-based system and Japan has traditionally been argued to be one of the archetypes of a bank-based system. However, as it was not possible to gather data on financial stress for all countries, the sample size was reduced. Thus, the sample is as big as data allows, and is composed of the following countries: Austria, Belgium, Czech Republic, Germany, Denmark, Spain, Finland, France, United Kingdom, Greece, Ireland, Italy, Netherlands, Poland, Portugal, Sweden and the United States. All countries included in the study can thus be categorized as developed, rich and well-functioning countries.
The dataperiod covered is 2002-2013, and thus covers both period with low and high levels of financial stress. As in in Pagano & Langfied (2016a), yearly data is used.

Data used in the paper stems primarily from the World Bank, and to a large extent the World Development Database by the Worldbank. The database is very recognized and widely used in the field (Beck, Levine, Demirgüç-Kunt, & Maksimovic, 2000; Langfield & Pagano, 2016a; Levine, 2002), and includes statistics on financial development and structure. More specifically, the database provides statistics on the size, activity, efficiency, and stability of banks, nonbanks, equity markets, and bond markets across 205 ecnomies over time (Cihak et

al., 2012).

The database is continuously updated, and was lastly updated in June 2016, and has been under quality control various times (The Worldbank, 2016). In addition, the World Bank has tried to reduce potential validity and reliability concerns associated with cross-country data collection, such as different degrees of measurement quality across countries and different accounting standards by collecting most raw data for all countries from one source. Sources used are, among others, the International Monetary Fund (IMF), the BankScope database (Bureau van Dijk Electronic Publishing), Bloomberg, Thomsen Reuters Datastream, Bank for International Settlemnets etc.

The fact that most data stems from one source, which additionally has put great effort into reduce potential validity and reliability concerns, stemming from for example differences in accounting standards, should reduce uncertainties related with cross-country studies as well as studies covering multiple years. Thus, this might increase the reliability of the result, despite the fact that collection of data across countries and time will most likely always be associated with some uncertainties.

In addition to data from the worldbank, this paper also relies on data from OECD. In addition, data financial stability stems from the European Central Bank for countries in Europe and the Federal Reserve Bank of St. Louis for the US.

6.2 Data variables

6.2.1 Dependent variable: Financial Stability

This paper will use the Composite Indicator of Systemic Stress (CISS) calculated by the European Central Bank, as this measurement is one of the few measures that is available on a larger cross-country scale. As the Composite Indicators of Financial Stress is not calculated for the US, however, the St. Louis financial stress index is used as well. Even though these two indeces are not identical, they are highly correlated[4] and has been used simulatenously by Blot, Creel, Hubert, Labondance, & Saraceno (2015) in their paper on financial stability and price stability. Using two different databases for financial stress, might, however, influence

[4] In fact, besides the Bloomberg Financial Conditions Index for EU at an overall level and the St Louis Financial Stress index, the CISS and the St. Louis Financial Stress index are the two indeces out of highligthed international indeces with the highest correlation (Kliesen, Owyang, & Katarina Vermann, 2012).

the reliability of the result, even though the two measures are designed to measure the same.

Composite Indicator of Systemic Stress (CISS) and St. Louis Financial Stress Index

The main general goal of the CISS and St Louis Financial Stress Index is to measure the current state of instability in the financial system and to summarise it in a single, usually continuous, statistic.

The CISS includes 15 raw, mainly market-based financial stress measures. These are split into the following categories: the sector of bank and non-bank financial intermediaries, money markets, equities and bonds markets as well as foreign exchange markets (Holló et al, 2012). Furthermore, the CISS places relatively more weight on situations in which stress prevails in several markets segments at the same time. Consequently, the CISS captures the idea that financial stress is more systemic and thus more dangerous for the economy as a whole if financial instability spreads more widely across the whole financial system. Systemic stress is interpreted as an ex post measure of systemic risk, i.e. risk which has materialized already.

The St Louis financial stress index is constructed from 18 weekly data series: seven interest rate series, six yield spreads and five other indicators (The Federal Reserve Bank of St. Louis, 2010). Each of these captures some aspect of financial stability, and the main assumption in the construction of the index is that financial stress is the most important factor in explaining the co-movement of these variables (The Federal Reserve Bank of St. Louis, 2010).

For a list of the constituents of variables included in the two indeces, see appendix 1.7.

While the average value of the STLFSI is designed to be zero, where zero represents normal financial market conditions, and values above zero suggest above-average financial market stress, the CISS is constrained to lie within the interval (0,1] (Holló et al, 2012).

Thus, in order to ensure the indeces are on the same scale, the STLFSI was normalized to lie within the interval (0,1] by applying the following formula:

$$z_i = (x_i - min(x)) / (max(x) - min(x))$$

where $x = (x_1,\ldots,x_n)$ and z_i is the i^{th} normalized data.

However, despite the fact that the two financial stress indeces are now on the same scale, one

can argue that issues still exist in relation to the reliability of the result due to the two indeces not being truly identical[5]. Thus, as a robustness test, the regressions are also run without the US.

6.2.2. Independent variable: Bank-market ratio (financial structure)

The literature measures financial structure by the size of the banking sector relative to the size of equity and bond markets, where the former sector is measured by either total asset of domestic banks or total credit from domestic banks, and the latter by the total market value of all listed shares on domestic stock exchanges and of outstanding domestic private debt securities (Gambacorta et al., 2014; Langfield & Pagano, 2016a).

In line with Pagano (2016a) the bank-market ratio is applied in this paper.
The bank to market ratio is calculated using two different methods:

(1) Private credit by banks/(Total stock and private bond market capitalization).
(2) Total bank assets/(Total stock and private bond market capitalization).

The reason two different ratios are used, is the fact that while it is common to use total bank assets as an expression for the size of the banking sector (Pagano & Langfield, 2016a), others argue that activities such as investment banking, undertaken by some universal banks, should instead be identified as market-based activities (Berlin, 2012)).
Thus, it seems reasonable to use private credit by deposit banks to GDP as well as total bank assets to GDP. For example, private sector credit to GDP was recommended by Demirgüc-Kant et al. in their 2012-paper.
To measure the size of capital markets, this paper follows the traditional literature and uses total stock and private bond market capitalization (Čihák et al., 2012).

In line with Langfield & Pagano (2016a), the definition of banks includes all credit institutions with a banking license to receive retail deposits, including savings institutions. Consequently, other monetary financial institutions, for example money market funds, are not included.

[5] Moreover, the fact that the CISS uses portfolio theory to aggregate the components while the St. Louis Stress Index relies on statistical methods, might also play a role.

6.2.3 Control Variables

Below, a short review of the control variables used in the regression can be found. Obvious factors influencing financial stability such as interest rates and stock market returns (or volatility) are not included, as they are included in the composite indicator measuring financial stress.

In addition, the fact that all countries in the sample are developed countries results in the fact that it is not necessary to control for factors such as the rate of inflation and political stability.

In Pagano & Langfield's (2016a) paper on bank-based and market-based economies in relation to systemic risk, they control for bank size and leverage. Thus, in line with Pagano & Langfield (2016a), bank size and leverage are controlled for.

Bank size

The argument for controlling for bank size is that large banks tend to be more interconnected with other banks, increasing their importance within financial networks (Pagano & Langfield, 2016a). In addition, larger banks tend to have less stable funding structures and more complex organizational structures, resulting in larger banks creating more systemic risk (Laeven, Ratnovski, & Tong, 2014) (Langfield & Pagano, 2016a).

Bank size is measured as the value of deposit money banks' assets to GDP, where despoit money banks are comprised of commercial banks and other financial institutions that accept transferable deposits, such as demand deposits (Čihák et al., 2012).

Leverage

Banks that are highly leveraged might have more systemic risk as they might require bank managers to take excessive risks due to the effect of low franchise value on shareholders' to 'gamble for resurrection' (Pagano & Langfield, 2016a).

Furthermore, as already outlined, an increase of bank leverage often precedents a financial crisis. In line with this, bank leverage sourced in wholesale financial markets was argued to be a defining feature of the last financial crisis, where banks relying on wholesale funding were able to "lever up" and was exposed to significant roll-over risk (Nier & Merrouche, 2010). Thus, in line with Nier & Merrouche (2010), to capture and approximate the build-up of

leverage sourced in wholesale markets, private credit by banks to bank customer deposits (%) at the country level is used.

In addition to the factors controlled for above, in relation to financial stability it seems reasonable also to control for some macroeconomic factors we well as other structural factors in relation to the banking sector. Thus, in line with Mohr & Wagner (2011), the following additional control variables are introduced:

GDP growth

Weaker GDP growth are viewed to raise the likelihood of banking crises, and higher volatility of output growth has been found to be related with higher crisis probability (Mohr & Wagner, 2011). GDP growth is measured as the annual percentage growth rate of GDP.

Credit Growth

Rapid growth in credit is a very common factors associated with especially banking crises, as credit growth can lead to serious asset price misalignments and financial imbalances (Mohr & Wagner, 2011). In addition, lending booms typically precede banking system instability (Jahn & Kick, 2012). Credit growth is measured as domestic credit to private sector (% of GDP) (Worldbank, 2016)

Bank concentration

A higher degree of consolidation may lead to less competition, higher profits, and consequently higher capital buffers. In line with this, concentrated banking systems have larger banks with more diversified portfolios (Mohr & Wagner, 2011). Contrary, less competitive environments may lead to higher risk-taking incentives and too-big-to-fail policies (Mohr & Wagner, 2011). In line with this, the empirical evidence with regards to bank concentration in relation to bank instability is ambiguous.

Bank concentration is measured as the assets of the three largest commercial banks as a share of total commercial banking assets (World Bank, 2016).

International banking integration

An overwhelming body of evidence seem to suggest that greater openness to foreign banks improves the soundness of the banking sector as they seem to transfer best practices, increase the credit supply and putting competitive pressure on domestic banks (Mohr & Wagner, 2011).
In line with this, abundant evidence has found foreign banks to have a stabilizing effect on aggregate lending during local bouts of financial turmoil (Beck, Degryse, De Haas, & Van Horen, 2014).
On the other hand, foreign banks may expose a country to foreign shocks, and foreign bank ownership may also affect the sensitivity of the aggregate credit supply to the business cycle as multinational banks trade off lending opportunities across countries (Beck et al., 2014).. The international banking integration is proxied by foreign bank assets among total bank assets (%).
In addition to the above, newer research has focused on banks' increasing engagement in more market-based activities, i.e. activities outside traditional bank lending in relation to financial stability (Laeven et al., 2014). Thus, banks' market-based activities are also controlled for.

Market-based activities
Banks have been argued to contribute more to systemic risk when they engage in more market-based activities, i.e. activities outside traditional bank lending (Laeven et al., 2014).. As in Laeven et al. (2014), this is proxied by the share of bank's noninterest income to total income (%).

In addition to the dependent, independent and the control variables already described, dummy variables for financial crisis are included in the regression. The dummy variable takes the value 1 if during a given year the given country is undergoing a financial crisis and 0 if not. The dating of the financial crisis relies on Laeven & Valencia (2013) database on financial crisis, including systemic banking crisis, sovereign debt and currency crisis, which is known for being one of the most comprehensive databases on financial crisis.

Including an interaction variable is in line with literature (Pagano & Langfield, 2016; Gole & Sun, 2013) and is done is order to explore if there are differences in the relationships between

financial stress and the bank-market ratio in periods at a general level and with a financial crisis.

6.3 Panel data and estimation techniques

6.3.1 Theoretical background of panel data

As this study looks into different countries over time, i.e. the data contains observations on multiple entities across time, the data is classified as panel data, also known as longitudinal data.

A panel data equation has the general form:

$$y_{it} = \beta_0 + x'_{it}\beta + u_{it}$$

where β is a vector of estimated parameters and x_{it} is a vector of explanatory variables. u_{it} is the error term, which will be discussed thoroughly in the next section. From the subscript *it* it is noted that the variables vary over both country (*i*) and time (*t*).

Panel data allow us to control for unobservarable entity effects or time effects of observations, which can affect the variables (Stock & Watson, 2012). For the sake of this paper, these could for example be national policies or cultural differences between countries, which might influence or interfere with the model. The effects can be either fixed or random, where "*a fixed model examines if intercepts vary across groups or time periods, whereas a random effect model explores differences in error variances*" (Park, 2009).

Thus, in studying financial system the fixed effects panel data approach has important advantages over cross-setion regressions, as estimates will no longer be biased by unobserved country-specific effects that are constant over time (Allen & Bartiloro, 2007).

Despite the above, entity and time fixed effects regression cannot control for omitted variables that vary *both* across entities *and* over time (Stock & Watson, 2012).

Some drawbacks of panel data are collection issues (i.e. coverage), non-response in the case of micro panels or cross-country dependency in the case of macro panels (i.e. correlation between countries) (Torres-reyna, 2007) (Torres-Renya, 2007) Furthermore, panel data

relies on more advanced statistical methods, which increases the complexity of working with it (Woolridge, 2013).

Additional terminology associated with panel data describes whether some observations are missing, i.e. the panel is unbalanced, or not, i.e. the panel is balanced.
The panel in this paper is unbalanced, as some countries have a few missing observations. Unbalanced panels can be a challenge, but most econometric packages take this into account (Stock & Watson, 2012).

6.3.2 Approaches for panel data: fixed effects versus random effects

For panel data, the random and the fixed effects approach are widely used among various approaches.

Fixed effects model

As already mentioned, a fixed effects model assumes that each entity (or in this paper, country) is influenced by either an entity (country) fixed or a time fixed effects, which changes the intercept of the entity. This implies that each entity has a unique intercept. Consider the below fixed effects regression model with entity fixed effects:

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

Here, Y_{it} is the dependent variable for entity *i* at time *t,* β is the coefficient for the explanatory variable X for entity *i* at time *t*, and *u* is the error term. The term α_i can be thought of as the "effect" of being in entity *i*, and is thus known as the entity fixed effect. The variation in the entity fixed effects comes from omitted variables that vary across entities but not over time (Stock & Watson, 2012). Consequently, if the entity effect is kept constant over time, changes to the dependent variable cannot be associated with entity effects, and must thus be caused by the variables in the model (Torres-Reyna, 2007).

The combined entity and time fixed effects regression model is:

$$Y_{it} = \beta_1 X_{it} + \alpha_i + \Lambda_t + u_{it}$$

where Λ_t is the time-fixed effect.

The combined entity and time fixed effects regression model eliminates omitted variables bias that comes both from unobserved variables that are constant over time as well as from unobserved variables that are constant across entities (Stock & Watson, 2012).

Random-effects model

Random and fixed effects make different assumptions about the error term. For convenience, let us compare the entity fixed effect model and the random effects model.

While the fixed effects approach assumes that the error term consists of two parts, a_i and u_{it}, where a_i can be correlated with the explanatory variables but u_{it} cannot, random effects assumes that both a_i and u_{it} are uncorrelated with the explanatory variables. Thus, the random effects model is based on the assumptions that "*the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model* (Torres-Reyna, 2007). This assumption is strong, and is by some viewed as a drawback of the random effects approach.

The equation for a random effects model is thus:

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

One can use the Hausman test in order to formally investigate whether the fixed effect model is the preferred approach (Torres-Reyna, 2007). In short, the Hausman test compares the etimates from a random effects approach with the estimates from a fixed effects approach and investigates if they differ significantly from each other. More specifically, the Hausman test has a null hypothesis H_0: $(\beta_{FE} - \beta_{RE}) = 0$, in which case the random approach is preferred.

The result of the Hausman test speaks for applying the random effects approach (see appendix 1.2). However, the test should be used with caution and one should also take into consideration theoretical arguments in deciding which test is more preferable (Wooldridge, 2013). When determining which approach to apply, Wooldridge (2013) argues that one should focus on whether it can reasonably be assumed that α_i is uncorrelated with all explanatory variables in the model. Furthermore, Wooldridge argues that for an analysis of aggregated data, effect effects are almost always more convincing than random effects (Wooldridge, 2013).

In line with this, Williams (2012) argues that various considerations will affect the choice

between a fixed effects and a random effects model. For example, if one believe there are no omitted variables in the model – or believe that the omitted variables are uncorrelated with the explanatory variables that are in the model – then a random effects model is probably best. The reason for this is that it will produce unbiased estimates of the coefficients, use all the data available, and produce the smallest standard errors (Williams, 2012).
However, if there are time constant omitted variables, and these variables are correlated with the variables in the model, then fixed effects models are preferable, as they may provide a means for controlling for omitted variable bias.
Various factors, that are hard to control for due to data limitations, such as differences in political systems, differences in legal systems, differences in regulation, cultural differences, etc, might influence financial stability. Thus, based on theory, using a fixed-model approach seems preferable. Thus, a fixed model approach will be applied in this paper, which furthermore is in line with Pagano & Langfield's recent study (2016a).

6.3.3 Assumptions for the Fixed Effects Model

In the following, the assumptions for the fixed effects model are presented with staring point in Stock & Watson (2012) and discussed in relation to the analysis of the relation between the bank-market ratio and financial stability.

Assumption 1: u_{it} has conditional mean zero: $E(u_{it} \mid X_{i1}, X_{i2}, \ldots X_{iT}, \alpha_i)=0$. Thus, the first assumption is that the error term has a conditional mean zero, given all T values of X for that entity.
When applying the fixed effects model, it is assumed that any endogeneity in the model is time-constant and disappears with the removal of the time-constant error term.
Assumption 2: $(X_{i1}, X_{i2}, \ldots X_{iT}, u_{i1,} u_{i2} \ldots u_{iT})$, i = 1, ….., *n* are i.i.d. drawn from their joint distribution. Thus, the second assumption is that the variables for one entity are distributed identically to, but independently of, the variabls for another entity.
Here, the "sample" is the EU and US. The sample, however, is limited due to data constraints, which has decreased the sample to not including all countries in the European Union.
Assumption 3: Large outliers are unlikely: (X_{it}, u_{it}) have nonzero finite fourth moments.
The dataset was checked for large outliers. No large outliers were found. Several observations

can be classified as borderline, however as there were no theoretical reasons for excluding the observations, they were kept.

Assumption 4: There is no perfect multicollinearity.

To detect multicollinearity, a test of the variance-inflation factors (VIF) was performed. As all of them were below 5, no violation of the assumption was found (see appendix 1.1). Furthermore, if perfect multicollineatity, Stata automatically is not able to run the regression, or automatically excludes the variables.

6.3.4 Model Determination

In line with Pagano & Langfield (2016a), panel regressions with fixed effects to control for time-invariant ubobserved heterogeneity across countries are used. Furthermore, time-fixed effects, used to control for effects that vary over time but not across countries, are used. As already outlined, it seems reasonable to apply both entity and country-fixed effects in order to avoid omitted variable biases caused by for example cultural differences or macroeconomic conditions.

In order to check if time fixed effects are needed when running a fixed model model, one can use the command "*testparm"* in Stata. This was done as an extra check, with the result that time-fixed effects are needed (see appendix 1.2).

Heteroskedasticity in the data set is tested for through a modified Wald-test. The test strongly rejects the null of homoschedastic data (see appendix 1.3). Furthermore, in panel data the varibles are typically autocorrelated, that is, correlated across time within entity. Thus, standard errors need to allow both for this autocorrelation and heteroschedasticity (Stock & Watson, 2012).

Consequently, the regressions are run with heteroschedastic and autocorrelation-consistent (HAC) consistent standard errors, or more specifically clustered standard errors.

The regression model is specified as:

$$\begin{aligned} Y_{it} = \beta_0 + \beta_1 BankMarket\ ratio_{it} + \beta_2 BankMarket\ ratio_{it} * Crisis_{it} + \ \beta_3 Crisis_{it} \\ + \beta_4 CreditGrowth_{it} + \beta_5 GDP\ growth_{it} + \beta_6 Leverage_{it} + \beta_7 Bank\ size_{it} \\ + \ \beta_8 Marketbased\ activities_{it} + \beta_9 Bank\ Concentration_{it} \\ + \ \beta_{10}\ International\ banking\ integration_{it} + \alpha_i + \Lambda_t + u_{it} \end{aligned}$$

7. Results

In order to get a better understanding of the data, the descriptive statistics of the data is biefly toched upon in the following section before focusing on the panel data results.

7.1 Descriptive statistics

The table below presents the means, standard deviations, as well as minimum and maximum values for the dependent variable, independent variable (in its two versions) as well as the various control variables.

Table 1: Descriptive Statistics

VARIABLES	Mean	Standard Deviation	Minimum	Maximum
Financial stress	0.2175	0.2236	0.0142	0.9839
Bank-market ratio (1)	1.0459	0.4345	0.2213	2.4506
Bank-market ratio (2)	1.2857	0.8011	0.2448	3.3990
Credit growth (%)	0.0270	0.0691	-0.2349	0.4017
GDP growth	1.2825	2.8344	-9.1325	7.9348
Leverage	137.208	64.9474	47.8864	367.0766
Bank size	112.0768	41.5704	39.2911	223.2295
Market-based activities	37.4121	11.5107	7.3944	79.6612
Bank concentration	71.3924	18.2595	23.2832	100
International banking integration	27.8645	27.5259	1	88

As can be seen in the table above, the mean for the financial stress ratio is 0.22, while the minimum value for the variable is 0.01 and the maximum value 0.98. These values are rather expectable taken the time period included in the sample into consideration, as the stress ratio goes from 0 – 1.

The mean of the bank-market ratio is 1.05 in the case where total credit is used, and 1.29 in

the case were total bank assets is used. Obviously, the mean is affected by the fact that the sample includes countries with a highly bank-based structure, influenced by the maximum values of 2.45 and 3.40, respectively.

As can be seen, the minimum and maximum values of credit growth and GDP growth also reflects the fact that the sample period covers periods with both high and low levels of stress. The values for the means seem reasonable, especially taking into consideration that the countries included in the sample are developed countries.

Examining the descriptive statistics for the rest of the control variables, the mean, minimum and maximum values seem reasonable. One could argue that the minimum value of international banking integration, proxied by foreign bank assets among total bank assets (%), seems rather low. However, based on the fact that I have no theory nor other data to challenge it, no changes are made.

7.2 Panel Data Results

The panel data results of the paper can be seen in table 2 below.

Table 2: Panel Data Results

VARIABLES	Financial Stress	
	(1)	(2)
Bank-market ratio (1)	-0.0808	
	(0.134)	
Bank-market ratio (2)		-0.0928
		(0.0780)
Bank-market ratio * crisis dummy	0.0552***	0.0641***
	(0.0114)	(0.0122)
Crisis dummy	0.0091	-0.000765
	(0.0544)	(0.0440)
Credit growth	-0.387	-0.409
	(0.276)	(0.265)
GDP growth	-0.0253***	-0.0257***
	(0.00522)	(0.00515)
Leverage	-0.00062	-0.000602
	(0.000645)	(0.000630)
Bank size	0.00443*	0.00444**
	(0.00215)	(0.00186)
Market-based activities	-0.00195	-0.00188
	(0.00181)	(0.00186)
Bank concentration	0.00243	0.00243
	(0.00173)	(0.00177)
International banking integration	0.00383***	0.00384***
	(0.00109)	(0.00105)
Constant	-0.609*	-0.604*
	(0.318)	(0.306)
Year-fixed effects	Yes	Yes
Observations	139	139
R-squared	0.767	0.741
Number of countries	16	16

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As can be seen from the results, the bank-market ratio is not significant. Thus, the result indicate that the bank-market ratio generally is not significantly correlated with the financial stress index. This results hold for both versions of the bank-market ratio ((1) & (2)), where banks in (1) is represented by total bank credit and (2) is represented by total bank assets. Even though one should be careful in interpreting results not being significant it can, however, be noted that the coefficient is negative, which might indicate that countries with a larger ratio of market-based financing inhibits more financial stress compared to countries with a larger ratio of bank-based financing.

The interaction variable between financial crisis and the bank-market ratio is positively correlated at the 1 % significance level. This result suggests that in times of a financial crsis, countries with more bank-based financing seem to have a higher level of financial stress. Likewise, this result suggest that during a financial crisis, countries with more market-based financing seem to have a lower level of financial stress. This result holds for both versions of the bank-market ratio.

The above results will be discussed more in depth in the next section of the paper.

From the results it can be seen that the following control variables are significant: GDP growth, bank size and international banking integration.
GDP growth is significantly negatively correlated to financial stress. This result is expected, as in times of high financial stress, GDP growth is expected to be negative. In line with this, as outlined in section 4.3, macroeconomic factors causing a shock in the economy and causing negative GDP growth often affect financial stability negatively.

Bank size is significantly positively correlated with financial stress as hypothesized, which possibly is due to the fact that larger banks create more systemic risk.

International banking integration is seen to be significantly positively correlated at the 1 % level, thus indicating that foreign banks increases financial stress. Thus, the negative effects outlined in last section such as foreign banks may expose a country to foreign shocks and

affect the sensitivity of the aggregate credit supply seem to trumph the outlined possible positive effects in relation to financial stability.

From the results it can be seen that the following control variables are insignificant: credit growth, leverage, market-based activities and bank concentration.
The fact that "leverage" (measured as leverage in the wholesale markets) is not significant is surprising, especially as the crisis revealed wholesale funding to be a major source of instability (International Monetary Fund, 2013). However, one can question if the fact that leverage, market-based activities and bank concentration are insignificant is because their effects might be captured in the control variable "bank size", as larger banks might possibly have more leverage, undertake more market-based activities and result in higher bank concentration (Laeven et al., 2014).

From the results it can furthermore be seen that the coefficient of the crisis dummy is insignifant and positive in (1) while being insignificant and negative in (2). One would expect the crisis dummy to be significantly positive, as the financial stress index naturally is constructed to peak during financial crisis. Thus the insignificant result is quite unexpected, but might however be explained by the fact that crisis dummies were applied for some countries in 2013, due to the fact that the database (updated in June 2013) had stated the financial crisis was "ongoing". These countries could, however, have recovered shortly after. In addition to the above, the financial stress level was rather high in the beginning of 2000 due to the early 2000 recession, which primarily affected the European Union in 2000 and 2001, and the United States in 2002 and 2003 (see financial stress graph in appendix, 1.7). The fact that this period is not classified as a financial crisis by the Laeven's & Valencia's database (2013) might partly explain the result.

In addition to the above, it is worth noticing that the R^2 values – 0.772 and 0.769 - are quite high.

Robustness test

In order to ensure that results are not potentially biased by the fact that the CISS and the St. Louis Stress Index are constructly slightly differently, an robustness test where the US is

excluded is performed.

Despite the fact that US is the archetype of the market-based financial system, it still seems reasonable to run the regression without the US, as the extent to which market-based financing is used across the Europe differs with some countries relying on market-based financing to a relatively large extent.

Table 3: Panel Data Results (Robustness Test)

VARIABLES	Financial Stress	
	(1)	(2)
Bank-market ratio (1)	-0.0987	
	(0.143)	
Bank-market ratio (2)		-0.105
		(0.0792)
Bank-market ratio * crisis dummy	0.0602***	0.0702***
	(0.00979)	(0.0106)
Crisis dummy	-0.0171	-0.0247
	(0.0591)	(0.0416)
Credit growth	-0.442	-0.471*
	(0.266)	(0.251)
GDP growth	-0.0241***	-0.0247***
	(0.00564)	(0.00547)
Leverage	-0.000825	-0.000788
	(0.000518)	(0.000514)
Bank size	0.00422*	0.00418**
	(0.00210)	(0.00172)
Market-based activities	-0.00229	-0.00219
	(0.00169)	(0.00175)
Bank concentration	0.00249	0.00248
	(0.00179)	(0.00184)
International banking integration	0.00332**	0.00338***
	(0.00112)	(0.00103)
Constant	-0.535*	-0.528*
	(0.297)	(0.289)
Year-fixed effects	Yes	Yes
Observations	132	132
R-squared	0.785	0.786
Number of countries	15	15

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

As can be seen by Table 3 above, the results without the US are very similar to the results with the US included.
The bank-market ratios (both (1) and (2)) are still insignificant, while the interaction variable between the bank-market ratio and financial crisis are still significantly positively related to financial stress at the 1 % significance level.
The results regarding the control variables obtained in the previous regression also remains the same.

To shortly conclude, the obtained results suggest a rejection of hypothesis 1, hypothesizing that bank-based financial systems are in general more financially stable compared to market-based financial systems.
On the other hand, the hypothesis that financial instability is worse in bank-based financial systems during financial crisis cannot be rejected.
The results will be discussed in the following section.

8. Discussion

8.1 Discussion of Results

Hypothesis 1: Bank-based financial systems are in general more financially stable compared to market-based financial systems

The insignificant bank-market ratio indicates that it is not possible to say that an increase or decrease in the bank-market ratio influences financial stress significantly. Consequently, it seems that neither countries with a more bank- or market-based structure in general can be found to inhibit or cause more financial stress.
Despite the fact that one should not interpret insignificant coefficients, the insignificant bank-market ratio is negative, which possibly could suggest that the bank-market ratio is negatively related to financial stress.
The result that the bank-market ratio is insignificant and negative is in contrast to the findings of Pagano and Langfield (2016a), who recently documented that an increase in the size of the banking system relative to equity and private bond markets is associated with more systemic risk.
It is worth noticing that Pagano's & Langfield's study and this paper covers almost the same

time period[6], and thus it seems unreasonable that differences in the sample period should drive the result. Pagano & Langfield includes 20 countries in their paper. As they do not specify which countries, besides the fact that they mainly compare Europe with the US in general in their article, the difference in results could possibly be driven by the fact that other countries are included. This seems rather unlikely, however, as fixed effects were used in order to control for time-invariant unobserved heterogeneity across countries. Instead, it might be the difference in the dependent variables causing different results. As a measurement for systemic risk, Langfield & Pagano (2016a) uses SRISK, which measures the euro-amount of equity capital that a bank would need to raise in the event that the broad stock index falls by 40 % over 6 months. Thus, one can argue that Pagano's and Langfield's measurement does not take the financial system as a *whole* into consideration in their measurement of systemic risk as this paper aims to, but focuses merely on the systemic risk in banks. Despite the fact that the financial markets and banks are interconnected, meaning that high systemic risk in banks possibly spreads to the rest of the financial system, this difference might play a role.
Furthermore, this study includes more control variables than what was included in Pagano & Langfield's study, as the literature on financial stability had pointed towards other control variables also being relevant (Mohr & Wagner, 2011). The study was, however, also carried out with fewer control variables in line with Pagano & Langfield (2016a) which still not yielded a significant bank-market ratio.

One can argue that the fact that the bank-market ratio was found to be insignificant is in line with theory, as theory was not able to establish a clear-cut hypothesis favourizing either bank-based or market-based structures in relation to financial stability in general.

Revising the theoretical arguments in relation to financial instability, according to the insignificant bank-market ratio obtained in this paper it seems that countries dominated by equity and bond financing do not inhibit significantly more financial stress in general due to increased volatility or uncertainty based on the claims of financial markets being "*complex, contingent and volatile"* (Gabor & Vestergaard, 2015). Thus, it does not seem that market-

[6] Pagano & Langfield's study covers the period 2000-2012, and his study covers the period 2002-2013

based systems, involving increased direct investor exposure to risk, in general are more uncertain and exhibits a significantly higher level of stress compared to bank-based systems as theory might suggest.

Likewise, the result that the bank-market ratio is insignificant does not suggest that banks are willing (and able) to extend credit and smooth the impact of shocks on their lending relationships in a way that in general ensures less financial stress in bank-based countries compared to market-based countries.
Even though the bank-market ratio is insignificant, one can however question if the fact that the ratio is negative might suggest that countries with a higher bank-market ratio inhibit less financial stress after all.

Hypothesis 2: Market-based financial systems are more financially stable compared to bank-based financial systems during a financial crises.

While the results do not yield a significant relationship between the bank-market ratio and financial stress, the interaction variables between the bank-market ratio and a financial crisis are significantly positively correlated with financial stress at the 1 % significance level in all regressions.
This result suggest that during a financial crisis, countries with a higher bank-market ratio, i.e. countries with more bank-financing compared to equity and bond financing, inhibits more financial stress, i.e. are more financially instable.
This result, in turn, is in line with Pagano & Langfields' results (2016a); in their results interaction variables between the bank-market ratio and a housing market crisis and stock market crisis, respectively, were significantly positive.

One can argue that the significantly positive interaction variable is also in line with Gambacorta et al.'s (2014) findings, namely that when recessions coincide with a financial crisis, countries that rely relatively more on bank financing tend to be more severely hit than countries relying on market financing. Despite the fact that Gambacorta et al.'s results are

based on real GDP loss rather than financial stress, it seems reasonable to relate the two results.

From a theoretical point of view, the significant and positive interaction variable seem to suggest that bank lending is more cyclical relative to market lending, at least in relation to financial crises. This seem to be consistent with the theory arguing that banks' leverage and the possible amplification effect cause them to be more cyclical and possibly more systemic vulnerable to crises. In turn, this goes somewhat against the traditional banking literature, which emphasizes that banks are prepared and able to smooth the impact of shocks on lending relationships.
The fact that countries with more bank-based financing are associated with significantly higher stress during a financial crisis might also be caused by the fact that banks due to maturity mismatches of their assets are more prone to runs, as earlier outlined. When the economy is more reliant on banks, this might create more financial instability and uncertainty.

The significant and positive interaction variable, indicating that during a financial crisis countries more reliant on equity and bond financing are more financially stable compared to countries relying more on bank-financing seem to confirm the "spare tire view" as outlined in section 5.1. Thus, the results seem to be in line with the idea that should banks fall in distress causing the supply of bank credit to contract, stronger capital markets can act as a stabilizing factor (spare tire), weaken the vicious bank/real sector and consequently causing less financial instability.

Allard & Blavy (2011) documented that market-based systems had faster recoveries compared to bank-based systems. Conditional on the fact that a country can be recovering while still being in a financial crisis, this might also explain the fact that bank-based systems seem to be associated with higher levels of stress in financial crisis compared to market-based systems. The theory suggesting that banks tend to engage in zombie-lending, while market-oriented systems tend to speed up the necessary deleveraging, might play an explanational role.

Overall discussion

To sum up, the results obtained in this paper suggest that there is in general no significant difference in financial stress between bank-based and market-based systems, i.e. countries relying relatively more on banks or equity and bond markets for financing.
Simulteanously, the results suggest that during a financial crisis, market-based structures seem to be more financially stable compared to bank-based structures. Thus, increasing the relative reliance on market-based financing, in the form of equity and bonds, compared to bank credit, seems desirable from a financial stability perspective. The implications of this in relation to the Capital Markets Union will shortly be discussed in the "Policy Recommendations" section.

In general, one can question if the fact that the results of this paper do not suggest to support the in theory well-known "relationship banking" feature is because banks during the last decades have changed character. More specifically, since the 1990s, banks have to a larger degree used wholesale funding – repurchase agreements (repos), brokered deposits, interbank loans, and commercial paper – to supplement retail (International Monetary Fund, 2013).
Furthermore, technological advances has increasingly made it possible for banks to engage in capital market activities and scale up their returns (Boot & Ratnovski, 2016). Indeed, more banks than previously have a diversified range of offered services and operating methods, and are for example managing risks in various markets, trading claims, and perfoming asset securization.
Consequently, movements in the financial markets impacts the profitability of assets or the availability of financing, and while the lending decision is still driven by the individual bank's view of a company's creditworthiness and their relationship with the borrower, the lending decision is now to a larger extent also affected by movements in the market (Hardie & Howarth, n.d.).
According to Hardie & Howart, banking has become increasingly 'market-based' and the distinctive feature of patient capital has decreased as "*the financial crisis has revealed that increasingly it is the market that determines both banks' capacity to lend and even the particular decision to lend. To lend to a company, a bank must have sufficient amounts of both*

capital – to be able to meet regulatory requirements – and liquidity – in temple terms, so as to have the cash to give the borrower" (Hardie & Howarth, n.d., p. 4).

According to Hardie & Howart, a bank's development towards being more market-based financed can be expressed and measured in three different ways;
Non-market based liabilities (deposits), could finance market-based assets, which is quite uncommon. The other possibility is, where loans exceed deposits, that market-based liabilities finance non-market based assets. Finally, a third possibility also exist: market-based assets are financed by market-based liabilities.
Based on the above, the fact that the control variable "*leverage"* measured as "bank credit to bank deposits" was not significant in the regressions is – as already outlined - quite surprising.
To sum up, it might be possible that banks' changing character can explain the seemingly lack of traditional risk smoothing, as the markets influence banks' lending decision to a much larger degree than beforehand.

It should be noted that for statistical reasons, the findings obtained can be applied only to similar developed countries.

As all the countries included in the sample are not purely bank-based or purely market-based, one should be careful about extenting the interpretation of the results to be about the "pure" effect of being solely bank-based or market-based. In line with this, it is difficult to assess if there might be an effect on financial stability of relying to a large extent both on capital markets and on banks. For example, it has been suggested that the "*procyclicality of leverage is likely to be more pronounced in financial systems where banks are more exposed to fluctuations in market values of assets – through their holdings of securities and their repurchase facilities, for example"* (Cardarelli, Elekdag, & Lall, 2011, p. 92). However, it can be argued that these effects are to some extent controlled for in this study by the inclusion of the control variable "leverage", measuring banks' leverage in wholesale markets.

8.2 Discussion of Possible Data Problems

There are several issues with this specific data set – and likely with data sets used in other papers.

First and foremost, the estimators are said to be consistent with a fixed T as N --> ∞. With 17 countries included in the study, N does not approach infinity. Additonally, few observations mean less precise estimators. However, as already outlined, the sample size of this paper is constrained by data availability. Nevertheless, the confidence in the estimates and the reliability of the paper would benefit from a larger sample size as well as larger sample period.

In line with this, one should bear in mind that the significant interaction variable between the bank-market ratio and the financial crisis only covers the latest financial crisis, which was also the case in the study by Pagano & Langfield (2016a). Obviously, however, the reliability of the result would increase had it been possible to cover more periods of financial crises.

Endogenoeity is a classical problem in any regression and is sometimes related to the causality in the model. If the explanatory variable depends on the dependent variable in an equation, the OLS estimator will typically provide inconsistent estimators. Consequently, the assumptions about the error term are invalid (Stock & Watson, 2012).

The problem of reverse causality is quite common in economic models, and have been outlined as a potential problem in papers looking into the relationship between financial structure and economic outcomes, especially growth (Gole & Sun, 2013). While theory suggest that countries typically become more market-based as they become more developed, which might cause reverse bias in studies on growth and financial structure (especially if developing countries are also included), it seems less likely that reverse causality between financial stability and financial structure exist.

Even though omitted variable bias is likely to be addressed using both entity and time fixed effects in the panel data regression, it is not possible to control for omitted variables that vary *both* across entities *and* over time. Thus, there might still be a chance for an omitted bias. Especially fiscal and monetary policy vary both across countries and over time, despite the fact that the countries in European Union are subject to the same monetary policy. The monetary policy between the European Union and the US, however, was quite divergent

during the last financial crisis, with the Fed being much more aggressive and the ECB in turn being more conservative (Kang et al., 2016).
In order to accommodate some of the issues outlined above in relation to omitted variable bias, one could consider to run the regression with only countries in Europe who are a part of or pegged to the Euro, as these are subject to the same monetary policy and, to some extent, fiscal policy. This, however, would reduce the sample as well as exclude both the UK and the US, which traditionally have been classified as the archetypes of market-based systems.

The literature has obtained mixed results when it comes to the impact of regulation on financial stability, with some strand of the empirical literature not finding regulatory governance to be associated with financial stability, including (Barth, Nolle, & Prabha, 2014), other literature find regulatory governance to have a beneficial influence on financial stability (Wagner & Mohr, 2011). As the point of introducing regulation is creating more financial stability, and due to the fact that critics blaimed the failure of regulation to have contributed to the last financial crisis, the fact that financial regulation is not controlled for might influence the reliability of the results as regulation might vary both across countries and time. Finding appropriate control variables for financial regulatio is quite difficult.

In addition, accounting differenceces may differ across countries, and these differences might systematically correlate with the bank bias (Jan Pieter Krahnen, 2016). European banks tend to use IFRS accounting rules, while the US banks rely on US GAAP. Notably, investment banking plays a major role of the balance sheet buildup of the largest European banks and in general, the IFRS has much stiffer requirements for netting derivative positions in comparison to US GAAP. Consequently, there are less total assets and a smaller bank bias under US GAAP accounting (Jan Pieter Krahnen in Langfield & Pagano 2016a).
The above problem, is, however, accommodated by running the regression with the bank-market ratio using bank credit instead of total bank assets, obtaining the same results.

In addition to the above, real state financing is also treated differently in some banking systems. Despite the fact that in Denmark mortgage credit institutions are widespread, in most of Europe housing loans and lending for corporate real estate is on the balance sheet of banks. In contrast, in the USA these assets are to a large extent passed on to co-called

government sponsored enterprises, Fannie Mae and Freddie Mac (Jan Pieter Krahnen in Langfield & Pagano 2016a; Kjeldsen, 2004). As housing loans and corporate real estate loans are some of the largest asset classes this might influence the bank-market ratio. In addition, as these loans might be quite sensitive to financial stability, it might influence the reliability of the results (Jan Pieter Krahnen in Langfield & Pagano 2016a).

8.3 Criticism of the old banks vs. markets dichotomy as measurement for financial structure

Even though great scholars are still using the bank-based and market-based classification of financial systems without further criqitue in their papers, after having worked with and studied the literature on banks-based and market-based systems extensively during the process of this thesis, aspects of the dichotomy that needs a critical assessment have become apparent. The process of observing and exploring in detail relative weaknesses and strengths of a theory as the research hereof intensifies, can be argued to be a natural part of the "Wheel of Science" (see section on "Research Approach"). Indeed, while theories are static, the reality is constantly changing. This especially to be relevant when studying topics such as financial structure and systems which are constantly developing.

As outlined in the last section, according to Hardie & Howarth, the fact that banking has become more 'market-based', in the sense that banks are increasingly relying on wholesale funding in addition to customer desposits and are influenced by interest rates in markets, might challenge the traditional bank vs. market dichotomy. Consequently, Hardie & Howarth (n.d.) argues for a new typology of national financial systems that distinguishes systems not only by the use of non-financial firms' directly market-based sources of financing, but also by the extent to which bank lending is itself market-based. This, they term as "'market-based banking".[7]

[7] The term "market-based banking" is not new, however Hardie's and Howart's use of it is. Previously, market-based banking was applied to the shadow banking system, however Hardie and Howart broaden the definition to include those parts of commercial banking that are also dependent on the market.

The bank-based market-based dichotomy focuses only on the banking sector, equity markets and private bond markets. While these segments are of critical importance, and while it is useful to use a simplified measure in order to approximate a country's financial structure, the classification does not fully capture the variety of financial landscapes across countries as well as the interlinkages between the different segments (Beck in Allen, Carletti, & Gray, 2015). For example, the dichotomy does not pick up the fact that in Denmark, covered bonds (mortgage credit institutions) have gained a central position in the Danish economy due to their long-standing activity as financial enterprises specializing in granting loans against mortages on real property. Neither would the bank-based and market-based comparison as such pick up the role of for example securitization, which played a huge role under the last financial crisis. Some strand of the literature seem to suggest that the relative importance of equity and bond-financing can be an indication for the general level of other alternative market-based securities, such as securitization for example, however.

In addition to the above, the bank vs. markets dichotomy has been critiqued for portraying banks and markets as substitutes rather than complements (Sawyer, 2014). If true, the development of the two could be a zero-sum game, meaning that each segment would develop at the expense of the other (European Commision, 2015a). Complementarities and co-evolvement between banks and capital markets are becoming more apparent, exemplified among others by securitization (Song & Thakor, 2010). However, the fact that banks and markets can be complements do not render the object of this thesis redundant. Looking into whether bank- or market-based systems are better for financial stability gives an indication for if policy markers should prefer to move in the direction of one system compared to another.

Bank-based and market-based dichotomy portrays banks and markets as alternative models of connecting savers to investors, mainly focusing on relative advantages within their different intermediation forms. Instead of only analyzing financial structure based on the relative importance of banks and markets, it may also be beneficial to consider and analyze the various institutions operating in a country. In line with this, an analysis of how the characteristics of the various financial instituions could potentially affect financial stability

may be warranted.

Globally, the financial system consist of an increasing share of non-bank institutions. The types of instituions comprised in the "non-bank financial instituations" category vary from mutual funds, pension funds, hedge funds, insurance companies, special-purpose vehicles, and private equity and venture capital firms. According to Pagano (2016b p. 5), most of these institutions can either be considered "bank-like" (and thus part of the banking system) or instead as part of the capital markets system, and consequently "*the prevalence of non-bank financial institutions in developed economies does not pose a challenge for the banks-markets typology of financial structure. The challenge is rather one of proper attribution, which depends on the nature of the economic function carried out by such non-banks."* In line with this, pension funds can be categorized as market-based, as they mostly invest in marketable securities traded on exchanges. This is also the case for private equity and venture capital firms, as they are funded by illiquid long-term liabilities and depend on the availability of initial public offerings in deep equity markets (Langfield & Pagano, 2016b).
According to Langfield & Pagano (2016b p. 6), "*Owing to the heterogeneity of the "non-bank financial instituions" category in the financial accounts, micro data on these institutions' economic functions would help researchers to refine measures of financial structure. Meanwhile, in the absence of better data, the measures presented* (the bank-market ratio, red) *are useful first-order approximations of financial structure."*

Even though the financial system today is increasingly complex, the market-based and bank-based classification is still deemed useful by academics. Furthermore, even though the measurement of bank-based and market-based systems, measured by the relevance of markets and equity and bonds market, is not perfect, academics have argued that is it a compromise needed (due to mostly data constraints) if one wishes to compare financial structure across borders (Phumiwasana, 2003).

8.4 Other dimensions of the Capital Markets Union that might influence financial stability

The statistical results of this paper suggest that in relation to financial stability, at a general level, there is no difference between countries relying relatively more on bank loans or equity and bonds for financing. The results also suggest that during a financial crisis, countries that rely relatively more on market-based financing relative to bank-based financing inhibit less financial stress.

With that in mind, it is interesting to look into if other dimensions of the capital markets union could influence financial stability. Thus, this section shortly discusses other dimensions of the Capital Markets Union project, in addition to the advancement of equity and bond markets, which might influence financial stability.

Cross-border capital mobilization

As outlined in section 2.2, one of the intensions of the Capital Markets Union is to attempt to mobilize capital by establishing a single capital market in the EU where investors can invest their funds across borders and businesses can raise funds irrespective of their location. The intention to increase cross-border investment flows obviously has advantages such as greater risk sharing, as one is able to hold a more geographically diversified portfolio of financial assets (Bank of England, 2015). However, if the shock in one country is sufficiently large, not only might risk sharing be inadequate to prevent financial instability in the economy hit by the shock, it could also result in financial stability spreading to other countries (Bank of England, 2015). Thus, it has been argued that the Capital Markets Union most likely will create new systemic risk by establishing new links between countries and entities. Links, that may only manifest themselves in times of significant stress (Danielsson et al., 2015). Additionally, the Capital Markets Union also makes it easier for speculative investments across Europe. This could contribute to a build-up of momentum and pro-cyclical systemic risk (Danielsson et al., 2015)

Securitization

In addition to the above, one of the first actions in the Action Plan included a comprehensive package on securitization (European Commission, 2015c). In the action plan, it is argue that

securitization can increase the availability of credit and reduce the cost of funding, thus contributing to a well-diversified funding base. Furthermore, securitization is argued to allocate risk to match demand (European Commission, 2015c). However, without going into further detail, after the last financial crisis securitization was blamed for allowing the "hot potato" of bad loans to be passed on to unwary investors (Shin, 2009). Nevertheless, it has been argued that the importance of securitization for financial stability actually stems from the ability of the shadow banking systems to increase total supply of credit to end-users (Shin, 2009)

Market movement of regulation

As already outlined, players in the capital market are not close to being as tightly regulated as banks. Thus, another potential source of vulnerability is that activities increasingly shift from more supervised and regulated areas to areas that are not. Indeed, concerns are that the Capital Markets Union project might lead to a further risk transfer from the more heavily regulated bank sector to less regulated areas, referred to as "shadow-banking"[8]. (European Commission, 2015a).

Barysch & Holzhausen (2016) argue that while regulators worry less about one of these financial entities getting into trouble, as these risks are mostly borne by the investor instead of the taxpayer, the regulators are more worried about the impact it could have on the stability of the wider financial system. Especially, regulators fear that the "herd" behavior of non-bank entities could amplify swings in asset prices and in that way could cause instability (Barysch & Holzhausen, 2016). Furthermore, capital market players could affect financial stability through their links with the banking sector. As an example, 8 % of the euro banks' balance sheet exposure is to "shadow banks", while investment funds and other non-banks entities (not insurance companies or pensions funds) hold 10 % of all bank debt securities in the eurozone (Barysch & Holzhausen, 2016). These numbers might increase by the introduction of the Capital Markets Union.

In line with this, non-bank instituions has been known for the creation of new innovative financial instruments, which might be hard to understand and – as in the last financial crisis –

[8] Financial entities outside the regulated banking system that performs credit intermediation, such as hedge funds, money market funds, repo activities (Kodres, 2013)

might lead to instability. In line with this, according to Barysch & Holzhausen (2016) financial innovation, in the form of new technologies and business models are, on the one hand, a huge opportunity to create more efficient capital markets and broaden access to funding. "*On the other hand, they might create risks for financial stability if they are not properly regulated"* (Barysch & Holzhausen, 2016).

In addition, Dell'Ariccia in Allen et al. (2015) argues that when direct funding become more widely available as well as cheaper, it is possible that more transparent firms (firms with fewer informational barriers and agency problems) will find it profitably to migrate outside of the banking system. As a consequence, in a "flight to captivity"[9] banks will reallocate their portflios in the direction of least transparent firms. However, if borrower opaqueness is correlated with risk, banks that retrench I nto these least transparent segments will be left with riskier loan portfolios (Dell'Ariccia in Allen et al., 2015).

European Commission's "Preventive" Actions

Despite the fact that specific financial regulations and directives is out of the scope of this paper, it should be mentioned that the European Commission insist that their approach to market-based finance is to deliver *"transparent and resilient market-based financing while tacking major financial risks"* (European Commission, 2015a). The Commission points to various pieces of legislation and work already put in place, such as the introduction of an EU regulatory framework for alternative investments funds (including private equity funds and hedge funds) in the Alternative Investment Fund Managers Directive, whereby all funds are subject to authorization and regulation (European Commission, 2015a).

Furthermore, risks in relation to securities lending and repurchase agreements are addressed through the Securities Financing Transaction regulation (European Commission, 2015a). In addition, having learned from the last financial crisis, it has been underlined that in the building of the EU securitization, the focus should be on simple, transparent and standardized securitizations (European Commission, 2015a).

Furthermore, the commission wants to address systemic risk stemming from more market-

[9] The "flight to captivity" effect is, among others, the result of the following "informational specificity"; banks should obtain higher profits from more captured (more opaque) borrowers than from borrowers with alternative financing options (Dell'Ariccia & Marquez, 2001)

based finance. This will be done together with the European Systemic Risk board, and the purpose is to monitor and assess issues concerning growing interconnectedness, sudden reductions in market liquidity as well as certain intermediation activities undertaken by non-banks (European Commission, 2015a).
The commission also looks at what kind of regulation might be needed for areas such as crowdfunding or loan-originating funds (Barysch & Holzhausen, 2016). In addition, the Commission argues that based on the fact that a more market-based financial system is dependent on greater participation by both individuals, retail investors and institutional investors, appropriated investor protection is important. As a result, the Commission points towards the fact that the European Securities and Markets Authority and the European Insurance and Occupational Pensions Authority have been allocated increased powers on investor protection through, among others, MiFID II, the Short selling Regulation and PRIIPS (European Commission, 2015a).

8.5 Is financial stability always the ultimate goal?

While financial stability is the focal point of this thesis, one can ask if financial stability should always be the ultimate goal?
In line with this, a report from the Central Bank Governance Group (2009) sugests that financial stability is not an absolute objective *per se*, and advices policymakers to consider the trade-off between financial stability and dynamic and allocative efficiency of financial intermediation.

As outlined in the section on financial stability, according to Chant et al. (2003) financial instability "*refers to conditions in financial markets that harm, or threathen to harm, an economy's performance through their impact on the working of the financial system.*
Furthermore, the European Central Bank (2015) describes financial stability "*as a condition in which the financial system – intermediaries, markets and market infrastructures – can withstand shocks without major disruption in financial intermediation and in the general supply of financial services".*
Thus, one can possibly argue that financial stability should be regarded as "a means to an end", and not as and end itself. Instead, financial stability should prevent major disruptions of

financial efficiency that can be detrimental for the economy and the economy's performance as a whole (Carneiro, 2011).

Fell & Schinasi (2005) points out that greater efficiency might be accompanied by higher levels of asset market volatility and of proneness to financial stress.
In line with this, according to Griffith-Jones (2003) cited in Carneiro (2011) "*while international financial efficiency cannot be achieved without market stability, stability without efficiency is pointless. The provision of both is a global public goo*d".

However, as the last financial crisis showed, it can be hard to foresee a financial crisis. Thus, one can argue that it might be important to monitor financial stress continuously and at least ensuring reasonable levels of financial stress seems sensible. In that sense, it might be relevant to consider whether one financial system is in general more financially instable, i.e. inhibits more financial stress, than the other.

9. Possible Policy Recommendations in relation to the Capital Markets Union

This section presents policy recommendations in relation to the Capital Markets Union based on this paper's findings on market-based and bank-based economies in relation to financial stability.

The results obtained in this paper suggest that, while there in general is no significant difference in financial stability between countries relying relatively more on banks compared to markets for financing, during a financial crisis, market-based economies seem to be less financially stressful.

Based on the assumption that more harm is caused with higher stress levels during periods of financial crisis, the results of this thesis suggest that it seems reasonable and beneficial to promote market-based financing, in the form of equity and bonds. Thus, the Capital Markets Union initiative seems advantageous for the implicated countries.

Furthermore, as it has been outlined that the development of Europe's high reliance on banks is to a large extent due to generous public support for banks and a political attitude favouring 'national champions', the "political" establishment of the Capital Markets Union seems like a necessary step in order to enhance more market-based financing as well as changing the culture in Europe.

As section 8.4 argues, the Capital Markets Union will, however, possibly create new systemic risks, which the relevant authorities need to understand. Thus, monitoring and assessing issues with regards to new systemic risk, which the Commission plans to do together the with European Systemic Risk board, seems highly relevant.

In addition to the above, as outlined in section 5.1 literature suggest that equity seems to offer the best trade-off between risk sharing and financial stability (Bank of England, 2015). Thus, it might be be benefical for the Capital Markets Union to focus extra action on obtaining this.

10. Conclusion

The Capital Markets Union was initiated in the beginning of 2015 by the European Commission with the aim to *"broaden the sources of financing in Europe towards nonbanking financing by giving a stronger role to capital markets"* (The European Commission, 2015a, p. 14). In the words of literature, the Capital Markets Union aims at pushing Europe's financial structure from a merely bank-based towards are more market-based one, measured by the relative role banks play in terms of financing relative to equity and bond markets.

Through a generally deductive approach, this paper aims to extend the academic discussion where it left off and by doing so supporting the Capital Markets Union debate regarding whether market-based financing leads to a greater degree of financial stability. This is done by investigating whether a bank-based or a market-based financial structure leads to more financial stability. So forth literature investigates the efficiency of each of the two financial structures in the intermediation of savings to investments and the effect of financial structure on growth. Only a subset of literature has touched upon financial structures' effect on financial stability and no common conclusion on this topic has been found to date. The main argument for a bank-based structure is its information production through relationship banking (Berlin and Mester, 1998). On the contrary, market-based banking's advantage is represented through the "spare tire view" and diversification beneifts, in which security market financing acts as a stabilizing factor when supply of bank credit fails (Levine, Lin, & Xie, 2016).

In order to determine how bank-based and market-based systems affect financial stability, this paper applies the old bank-market dichotomy in econometrically analyzing whether and how a bank-market ratio affects financial stability. The latter is proxied by The European Central Banks' Composite Indicator of Systemic Stress and the St. Louis Financial Stress Index. An unbalanced panel of 17 countries, including USA and 16 European countries, ranging from 2002-2013 is modelled using panel data with fixed effects. A subset of control variables; bank size, bank leverage, GDP growth, credit growth, bank concentration, international banking integration and marked based activities are added to capture other variances affecting the dependent variable.

The aim of the research was to examine how market-based and bank-based financial structures affect financial stability.
While the results of the paper does not suggest that either market-based or bank-based systems are in general more associated with financial stress, the results suggest that market-based structures seem to provide a greater degree of financial stability, in the form of significantly less stress, during financial crises. Thus, after all, from a financial stability point of view, the results obtained in the paper seem to suggest that market-based structures, relying relatively more on equity and bonds compared to bank-financing, are preferable compared to bank-based structures. In that sense, the establishment of the Capital Markets Union seems advantageous.
It might be possible to explain this paper's obtained results through markets' "spare tire". Furthermore, the fact that relationship banking does not seem to result in a higher level of financial stability, which is somewhat expected based on traditional banking literature, might be based on the fact that banks are increasingly becoming more "market-based", which negatively affects their ability and willingness to smooth the impact of shocks on lending relationships. Another explanation for why countries reliant on relatively more bank-financing seem more financial stressful during financial crisis, might be due to their large extent of leverage and a possible amplification effect of this (Pagano, 2016a).

Despite the fact that this paper has tried to mitigate potential bias in order to increase the results' reliability, for example by its use of both country fixed and time fixed effects, the results are subject to several data and methodology limitations, such as limited sample size and potentially omitted variable bias. However, despite of the above, this paper raises fundamental questions to existing literature, provides support to the Capital Market Union and provides a point of departure for further research.

11. Suggestions for Future Research

The findings of this paper encourages deeper level of research on bank-based and market-based financial systems in relation to financial stability.
The strongest encouragement from this paper for future research is to test on a bigger sample

and with more periods of financial crisis included, if market-based systems are still found to be significantly less associated with financial stress during financial crises.

As a complement to running the regression with financial stress as the dependent variable, future research could consider to complement the study by including growth in GDP (or GDP loss) as the dependent variable. This is interesting, as one can argue that financial stability is a "mean to an end", namely preventing major disruptions of financial efficiency in the real economy. Most importantly, complementing the results found in this paper with regressions run with GDP growth (or GDP loss) would allow one to examine whether the significant difference in financial stress between bank-based and market-based systems during financial crises actually manifests itself in an impact on the real economy.

As it has become obvious that the financial system in the future is becoming increasingly more intertwined and complex, it might be beneficial for future research to modify the traditional bank-market dichotomy accordingly, for example by characterizing banks by the degree they are "market-based" and include this feature in the regression.
If data allows, future studies might also benefit from including non-bank institutions and in relation hereto alternative debt and equity instruments into the bank-market ratio.

Future research is encouraged to create financial stress indexes themselves – thus being able to ensure that the stress indexes are constructed identically across countries while still taking the financial system as a *whole* into consideration. This would allow future researchers to increase the sample size as well as the time period covered. In turn, this would increase the reliability and validity of the results. Especially, it might be beneficial for future research to include more periods of financial crises, as the significant interaction variable obtained is this study is based only on the last financial crisis.

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Appendix

1.1 Testing fixed effects assumption 4: Multicollinearity

Note: As it was not possible to run the VIF-test for multicollinearity after using the "xtreg" specification for running panel data fixed effects in Stata, the function "regress" was used with entity and time-dummies.

```
. vif

    Variable |       VIF       1/VIF
-------------+----------------------
     bmcrisis |      3.41    0.292853
 Crisisdummy |      2.50    0.400485
   lbmratio1 |      2.10    0.476630
   GDPgrowth |      1.65    0.607156
    Leverage |      1.32    0.760074
  Bankingcon |      1.28    0.778491
Internatio~g |      1.18    0.845841
creditgrowth |      1.17    0.855656
 mktbasedact |      1.07    0.936768
-------------+----------------------
    Mean VIF |      1.74
```

Note: Stata Output

1.2 Hausman test & test for year-fixed effects

Hausman test:

```
. hausman fixed random

                 ---- Coefficients ----
                 (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
                 fixed        random       Difference          S.E.
-------------------------------------------------------------------------------
creditgrowth     .0961068     .2518309      -.1557241        .0540083
   GDPgrowth      .005837     .0003149       .0055221        .0035884
 Crisisdummy     .1527144     .1357989       .0169155        .0186867
    Leverage    -.0010486    -.0014212       .0003726         .001451
 mktbasedact    -.0022096    -.0035366        .001327        .0012683
    Banksize     .0094973     .0039563       .0055409        .0017422
  Bankingcon     .0044432    -.0013142       .0057573        .0025773
Internatio~g     .0023533       .00266      -.0003066        .0029371
    bmcrisis     .0117437      .044948      -.0332043        .0085303
-------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(9) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       34.77
                Prob>chi2 =      0.0001
                (V_b-V_B is not positive definite)
```

Note: Stata Output

Test for fixed year-effects:

```
F test that all u_i=0: F(15, 104) = 1.94                     Prob > F = 0.0269

. testparm _IYear*

 ( 1)  _IYeara2004 = 0
 ( 2)  _IYeara2005 = 0
 ( 3)  _IYeara2006 = 0
 ( 4)  _IYeara2007 = 0
 ( 5)  _IYeara2008 = 0
 ( 6)  _IYeara2009 = 0
 ( 7)  _IYeara2010 = 0
 ( 8)  _IYeara2011 = 0
 ( 9)  _IYeara2012 = 0

       F(  9,   104) =   14.96
            Prob > F =    0.0000


.
end of do-file
```

Note: Stata Output

1.3 Testing for heteroscedasticity in the model

Heteroschedasticity can be tested for by the command xttest3 in Stata, which is a test that calculates a modified Wald statistic for groupwise heteroscedasticity of the residuals from a fixed effects model. The H_0 assumes homoscedasticity and the test statistics is chi-squared with N degrees of freedom, where N is the number of cross sectional units. In the case of hetereskedasticity being present, the standard errors are no longer valid as they will be larger than they actually are if the idiosyncratic errors have a constant variance across time. Heteroscedasticity implies that the estimaters are not efficient (Verbeek, 2012). One way to avoid misleading inference based on "wrong" standard errors is controlling for heteroscedasticity. This can be done in Stata by typing "robust" after a regression". As can be seen below, the the H_0 was rejected when running the test for homoscedasticity.

```
Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (17)  =     156.20
Prob>chi2 =      0.0000
```

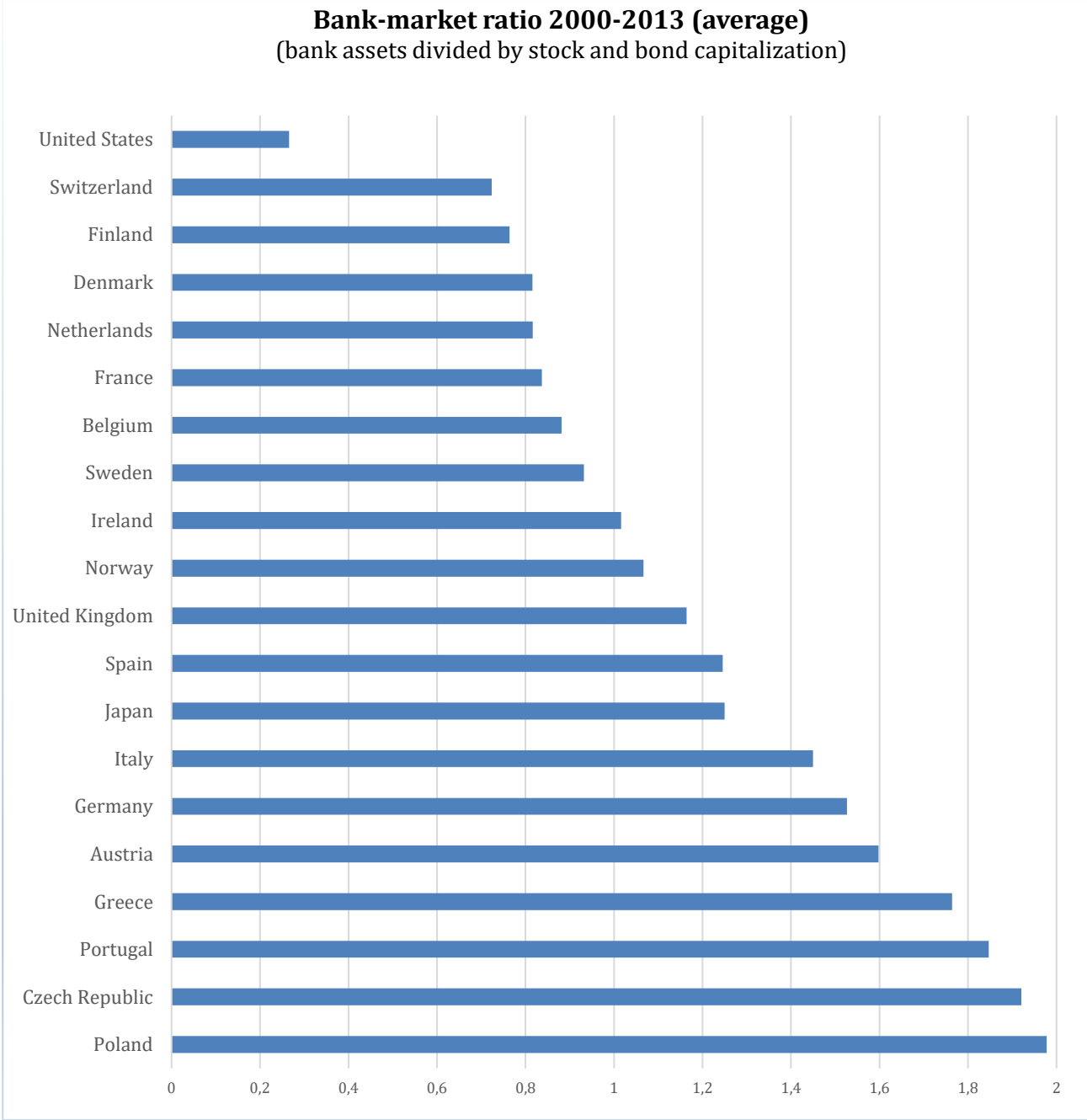
Note: Stata Output

1.5: Components of the European Central Bank's Composite Indicator of Systemic Stress (CISS) and the St. Louis Fed's Financial Stress Index (STLFSI)

STLFSI	
Interest Rates	• Effective federal funds rate
	• 2-year Treasury
	• 10-year Treasury
	• 30-year Treasury
	• Baa-rated corporate
	• Merrill Lynch High-Yield Corporate Master II Index
	• Merrill Lynch Asset-Backed Master BBB-rated
Yield Spreads	• Yield curve: 10-year Treasury minus 3-month Treasury
	• Corporate Baa-rated bond minus 10-year Treasury
	• Merrill Lynch High-Yield Corporate Master II Index minus 10-year Treasury
	• 3-month London Interbank Offering Rate–Overnight Index Swap (LIBOR-OIS) spread
	• 3-month Treasury-Eurodollar (TED) spread
	3-month commercial paper minus 3-month Treasury bill
Other Indicators	• J.P. Morgan Emerging Markets Bond Index Plus
	• Chicago Board Options Exchange Market Volatility Index (VIX)
	• Merrill Lynch Bond Market Volatility Index (1-month)
	• 10-year nominal Treasury yield minus 10-year Treasury
CISS	
Money market	• Realized volatility of the 3-month Euribor rate
	• Interest rate spread between 3-month Euribor and 3-month French T bills
	• Monetary Financial Institution's (MFI) emergency lending at Eurosystem central banks: MFI's recourse to the marginal lending facility, divided by their total reserve requirements
Bond market	• Realized volatility of the German 10-year benchmark government bond index
	• Yield spread between A-rated non-financial corporations and government bonds (7-year maturity bracket)
	• 10-year interest rate swap spread
Equity market	• Realized volatility of the Datastream non-financial sector stock market index
	• CMAX for the Datastream non-financial sector stock market index
	• Stock-bond correlation
Financial interme-diaries	• Realized volatility of the idiosyncratic equity return of the Datastream bank sector stock market index over the total market index
	• Realized volatility calculated as the weekly average of absolute daily idiosyncratic returns
	• Yield spread between A-rated financial and non-financial corporations (7-year maturity)
	• CMAX as interacted with the inverse price-book ratio (book-price ratio) for the financial sector equity market index
Foreign exchange market	Realized volatility of the euro exchange rate vis-à-vis the US dollar, the Japanese Yen and the British Pound

Source: Hollo et al. (2012) and Federal Reserve Bank of St. Louis (2010).

1.6 Bank-Market ratio 2000-2013 (bank assets divided by stock and bond capitalization)

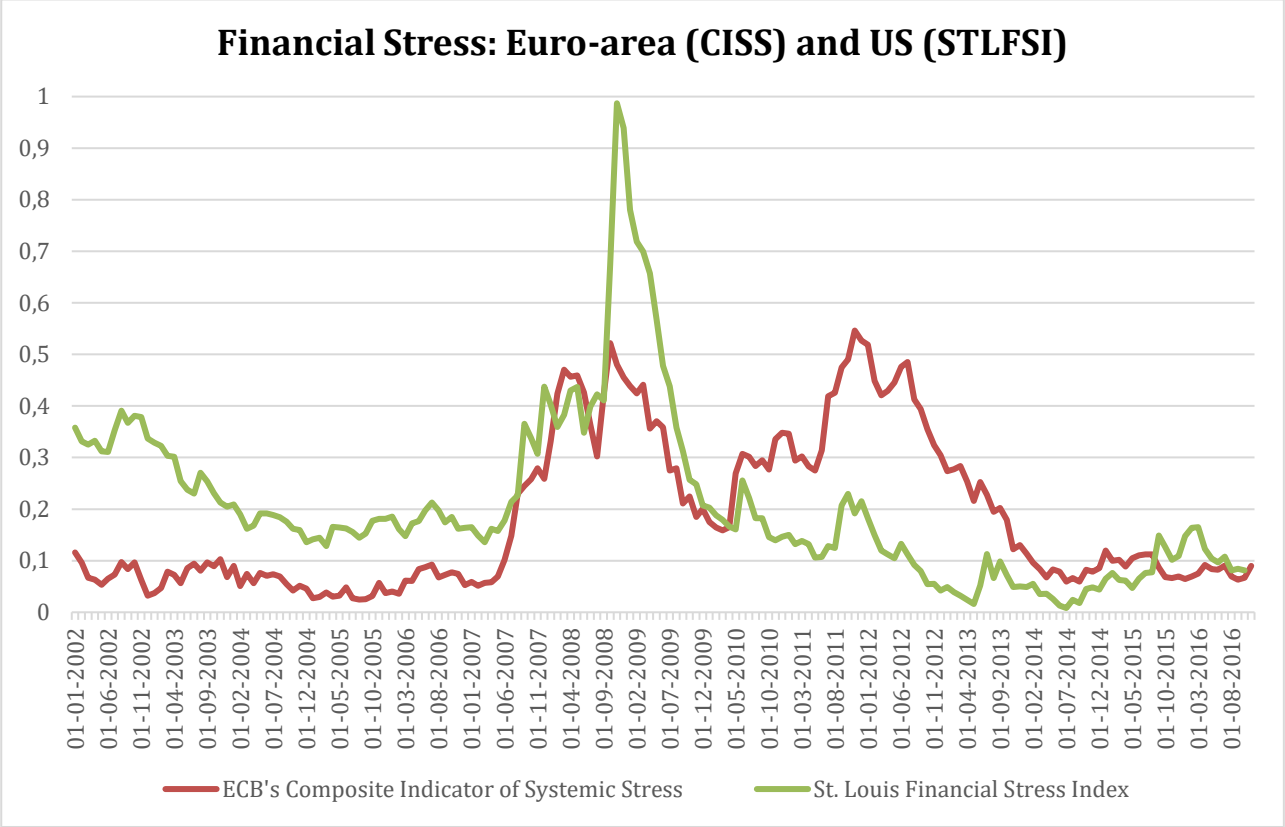


Source: World Bank, Global Financial Development Database (2016)

Notes: The bank-market ratio is defined as total bank assets to stock and private bond market capitalization (Čihák et al., 2012)

Notes: For more specific definitions, see appendix 1.8.

1.7 Comparison of financial stress in the euro-area (proxied by CISS) and in the US (proxied by STLFSI) over the sample period



Note: In the figure above, the St. Louis Financial Stress Index covers financial stress in the US, while ECB's Composite Indicator of Systemic Stress covers stress in the euro-area (GDP weights).

In the financial regressions, CISS data on country level is used.

1.8 Definitions of bank credit, bank assets, stock market capitalization and bond market capitalization

Reference/category in this paper	Reference/category in the World Bank database	Description in World Bank database
Bank credit	Private credit by deposit money banks to GDP (&)	*The financial resources provided to the private sector by domestic money banks as a share of GDP. Domestic money banks comprise commercial banks and other financial institutions that accept transferable deposits, such as demand deposits.*
Bank assets	Deposit money bank assets to deposit money bank assets and central bank assets (%)	Total assets held by deposit money banks as a share of sum of deposit money bank and Central Bank claims on domestic nonfinancial real sector. Assets include claims on domestic real nonfinancial sector which includes central, state and local governments, nonfinancial public enterprises and private sector. Deposit money banks comprise commercial banks and other financial institutions that accept transferable deposits, such as demand deposits.
Stock market capitalization	Stock market capitalization to GDP (%)	Total value of all listed shares in a stock market as a percentage of GDP.
Bond market capitalization (private bond capitalization)	Outstanding domestic private debt securities to GDP (%)	Total amount of private debt securities (amount outstanding) issued in domestic markets as a share of GDP. It covers data on long-term bonds and notes, commercial paper and other short-term notes.

Source: World Bank, Global Financial Development Database (2016)