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Essays on Selected Aspects of European Integration

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Chapter 1

General Introduction and Motivation

1.1 General Introduction

European integration considerably developed in the aftermath of World War II. Ideas and early attempts to bring Europe together melted into the creation of the European Union (EU), which today includes 28 countries (as of August 2015). 19 of these countries have adopted the euro, which represents the most advanced status of integration. However, there are still challenges ahead for Europe. The recent European debt crisis revealed many weaknesses, which have to be addressed to enhance further (economic) integration in Europe.

This thesis discusses different aspects of European integration. Doing so, it focuses on the economic components of this discussion. The selection of different aspects of European integration ranges from standard macroeconomic issues, such as institutions, fiscal policy and currency regimes to the German banking market. This chapter introduces and motivates this selection of different aspects of European integration.

The general introduction provides an understanding of the relevant aspects of European integration, in order to equip the reader with the necessary knowledge to put the research questions, which will be addressed separately in the following chapters, into context. It is important to disentangle the economic dimension from the overall framework of European integration. The economic component of European integration is the centrepiece of my thesis. However, although the EU and the euro area are different frameworks, they are also overlapping. Many policy measures can be understood as a response to the current European economic crisis (as of August 2015). Hence, the European crisis and some measures (expected) in response will be examined in some detail. This general introduction is followed by a general motivation of the whole work. An outline of my thesis closes this chapter.

This chapter also connects the different analyses I conducted for my thesis. The different research questions addressed in this thesis all relate to and are connected by the issues introduced in this chapter. The motivation of this thesis is partly driven by the institutional design of the EU, the still existing economic potential of European integration and the emergence of a severe economic crisis in Europe. In addition, there is a methodological motivation for my thesis. Given the recent increase in the availability of microeconomic-data, I make use of this development in a macroeconomic setting.

It is noteworthy that, due to the unique design of the EU, history outside of Europe offers some lessons but in general it offers only a poor analogy (O'Rouke and Taylor, 2013; Alesina and Perotti, 2004). This makes my research topic both interesting and challenging, but it also means that an extensive historical overview of unions or monetary agreements outside of Europe is not required for the scope of this thesis. However, this does not imply that economic history does not provide lessons at all. With respect to the recent economic crisis in Europe, for example, economic history can tell us a lot (e.g. Schularick and Taylor, 2012; Schularick, 2013; Jordà et al., 2013; Reinhart et al., 2012).

1.1.1 European Integration

The idea and the origins of European integration are well summarized in a quote by Spolaore (2013):

"At the end of World War II, the promoters of European integration looked back at the previous decades and saw a continent fragmented in independent and unconstrained nation states which had pursued costly beggar-thy-neighbor policies during the Great Depression and engaged in two major wars. The goal of European integration was to create a system where nation states would no longer follow such unilateral and destructive policies."

The idea of integration led to the creation of the Council of Europe in 1949 following the foundation of the Organization for European Economic Cooperation (OEEC) in 1948. The OEEC was succeeded by the OECD in 1961. In 1951, the European Coal and Steel Community (ECSC) was initiated based on the treaty of Paris. Based on the treaty of Rome in 1957, the European Economic Community (EEC), which became the European Community in 1993 and became part of the EU's wider framework in 2009, was founded. In 1969, the EEC decided to declare an economic and monetary union as an official goal of European integration. The European Union was officially initiated based on the Maastricht treaty in 1992, which came into force on 1 November 1993. The Maastricht treaty was followed by the Lisbon treaty in 2009. As of August 2015 the EU consists of 28 member countries[1].

There are three institutions involved in law-making at the European level. First, the European Parliament, which is directly elected by and represents the EU's citizens. Second, the Council of the European Union, which represents the governments of the individual member countries. The Council of the European Union is where

[1] Austria (1995), Belgium, Bulgaria (2007), Croatia (2013), Cyprus (2004), Czech Republic (2004), Denmark, Estonia (2004), Finland (1995), France, Germany, Hungary (2004), Ireland, Italy, Latvia (2004), Lithuania (2004), Malta (2004), Netherlands, Poland (2004), Portugal (1986), Romania (2007), Slovak Republic (2004), Slovenia (2004), Spain, Sweden (1995) and the United Kingdom. Years in parentheses refer to the accession date if it was after 1 November 1993.

governments defend their national interests. The EU's agenda is set by the European Council. The European Council comprises national heads, out of which one is the president of the council, and the president of the European Commission. The European Commission, the third of the three law-making institutions, represents the interests of the Union as a whole. In addition, there are other EU institutions like the Court of Justice of the European Union, or the European Central Bank. The European Central Bank is an example of a specialized interinstitutional body, since it leads the cooperation of national central banks in the eurozone.

The hybrid design of the EU, already mentioned in the preamble to the treaty of Rome, describes a union that includes intergovernmental, supranational, federal, confederal and functional elements. Together with its complex institutions, structures and procedures, this design of the EU defies a definition in conventional political terms (Diez and Wiener, 2009). Alesina and Perotti (2004) describe this mix of intergovernmentalists and supranationalist or federalists as a natural conflict regarding the future shape of Europe. In addition, due to the fact that the EU can be understood as a union of independent countries, Alesina and Perotti (2004) deny an understanding of the EU as the "United States of Europe". European integration as carried out by the EU is additionally related to political and social integration. Having said that, the focus of my thesis is solely on the economic aspects of European integration.

At the EU conference in Lisbon in the year 2000, European leaders articulated the goal to make the European Union "the world's most dynamic and competitive economy within ten years" (Blanchard, 2004). Four years later, Blanchard (2004) describes this goal as largely empty and pathetic. Eleven years later and just before I started this work, Sapir (2011) illustrates the overall situation - in an unfortunate context - of European integration:

"The year 2011 is likely to be a watershed in the history of European integration with the euro-debt crisis having started a process going either forward toward political unification or backward in time if the monetary union collapses."

Roughly four years later, we have witnessed a process going forward toward more unification. However, there are still measures on the agenda and many measures not yet fully implemented. To approach this topic, I will now focus on the economics of European integration.

1.1.2 Economic Integration

From an economic point of view, different stages of integration can be distinguished (Balassa, 2011), which are increasingly demanding in terms of the abolishment of discriminatory measures: in a *free-trade area* tariffs between the participating countries are abolished, but each country retains its own tariffs against nonmembers; a *customs union* includes the equalization of tariffs in trade with nonmembers as well as the suppression of discrimination in the field of commodity movements within the union; in a *common market* not only trade restrictions, but also restrictions on factor movements are abolished; in an *economic union* some degree of harmonization of national economic policies is required; finally, *complete economic integration* requires the unification of monetary, fiscal, social, and countercyclical policies as well as the setting-up of a supra-national authority.

Even though its stages can be illustrated in ascending order, economic integration is not necessarily a sequential process. Economic integration can, for example, be introduced in the form of a common market and stay at this stage forever. An important distinction has to be made regarding the motives for different stages of economic integration. Whereas a free-trade area is supposedly economically motivated, complete economic integration is also driven politically (Sapir, 2011). These differences in motivation are also reflected in different approaches to European integration. Until 1995, for example, some European countries which are today EU

member states were part of the European Free Trade Association (EFTA). In comparison to the European Economic Community at the time, the European Free Trade Association was solely economically motivated.

Naturally, economic issues can be decomposed into costs and benefits. According to Spolaore (2013), the costs and benefits of European integration arise due to heterogenous populations. Spolaore (2013) broadly summarizes the following major costs: the provision of the ultimate "public good", namely the federal government about which people from different countries may have very different views; according to (Alesina et al., 2003) there is microeconomic evidence that links ethnic heterogeneity to an underprovision of public goods at the local level; there is also macroeconomic evidence of negative correlations between ethnolinguistic fractionalization and government performance (Alesina and La Ferrara, 2005). The main benefits of European integration are: economies of scale with respect to the provision of public goods; the ability to internalize positive and negative externalities over a large area; redistribution policies, which could provide insurance against asymmetric shocks given that an overall budget exists.

Obviously, costs and benefits are interrelated. In addition, economic integration theoretically provides welfare effects through three different channels: trade, terms-of-trade and factor movements.[2] Moreover, dynamic effects due to economies of scale are beneficial as well. A larger market could facilitate economies of scale in production, which in turn causes productivity gains and growth (Balassa, 2011).

Since the European project includes economically very different countries, the concept of convergence has to be mentioned. The EU includes very mature economies such as Germany and the United Kingdom, but also much less mature economies in Central and Eastern Europe. Figure 1.1 compares gross domestic product (GDP) per person employed[3] in Central and Eastern European Countries (CEECs), that

[2]See Sapir (2011) for a summary of the related empirical literature.

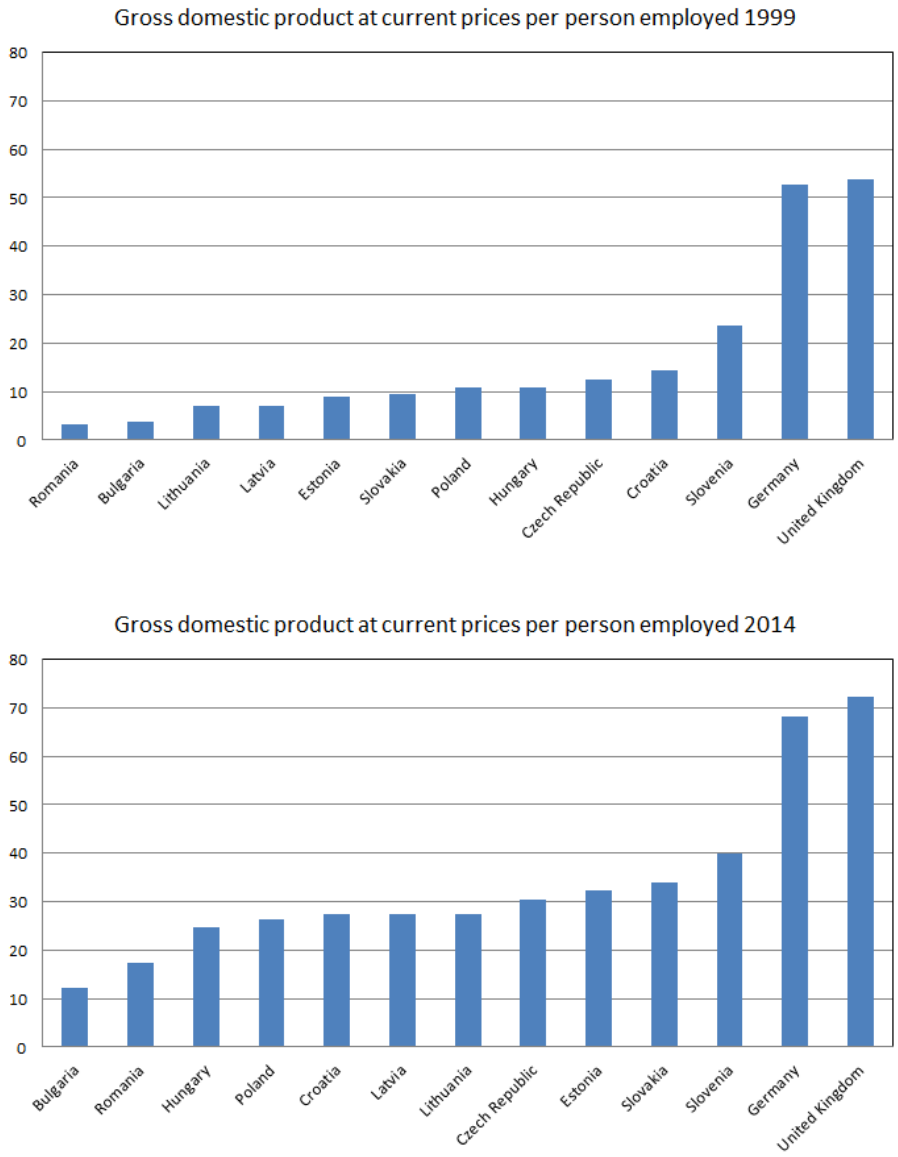
[3]It should be noted that this is only a generic approximation of productivity due to the omission of the capital-labor ratio (Blanchard, 2004).

are part of the EU with Germany and the United Kingdom for 1999 and 2014. This graph is highly selctive, since it excludes a number of European countries ranging economically between the illustrated countries. The comparison over time shows a significant increase in GDP per person employed for all CEECs, which is in line with the convergence identified by the ECB (2015). All CEECs that are part of the EU more than doubled their GDP per person employed. There is still some distance to mature economies such as Germany and the United Kingdom; however, visual inspection also reveals that this distance has decreased on average over time. Finally, Figure 1.1 confirms that there are still considerable economic differences across the illustrated EU countries. Hence, the potential for further convergence still exists.[4]

Economically, real convergence measured by real GDP per capita is of main interest and supported by economic integration. Real convergence is the catch-up of lower income countries in terms GDP per capita with higher income countries. However, there are also the complementary concepts of beta convergence (β-convergence) and sigma convergence (σ-convergence). Beta convergence refers to low income countries growing faster than high income countries. Sigma convergence represents a reduction in dispersion of income levels across countries. In a recent report, the European Central Bank finds different patterns of convergence in Europe (ECB, 2015). It is found that there was some real convergence in the European Union since 1999. This is due to the catch-up of CEECs. However, within the euro area, which will discussed in the next sub-chapter, no process of real convergence among the twelve countries which adopted the euro between 1999 and 2002 could be observed.

[4] In Chapter 4 one source of further economic convergence will be illustrated.

Figure 1.1: Gross domestic product at current prices per person employed for selected countries and years



Notes:

(1) Gross domestic product at current prices per person employed is measured in keur.

(2) Source: Ameco.

1.1.3 Euro Area

Based on two principles, the Maastricht treaty paved the way towards monetary union in Europe. These principles are gradualism and convergence[5].

The declaration of the European Council in Brussels in May 1998 stated that eleven European countries[6] were going to create a monetary union. This marked the beginning of the euro area. The exchange rates among member states were fixed in January 1999, although the euro was introduced physically only in 2002. By now, the founder states of the euro shared considerable experience of a centralized monetary policy being accompanied by common fiscal discipline measures, defined by the Maastricht Convergence Criteria and the Stability and Growth Pact. So far, eight more countries[7] have joined the currency club (as of August 2015). The euro area, which constitutes the most advanced status of association within the process of European integration, has never before attracted so much attention as at the present time. The European sovereign debt crisis within the euro area has brought up doubts about the idea of a common European currency and a centralized monetary policy.

The theoretical foundation for a monetary union is given by the Optimum Currency Area (OCA) theory. Based on OCA theory, a sufficient degree of business cycle synchronization is required to constitute an optimum currency area (Mundell, 1961; McKinnon, 1963; Kenen, 1969). It is noteworthy that the euro area scores poorly according to OCA theory (Wyplosz, 1997; O'Rouke and Taylor, 2013).[8] However, the single currency contributes to deepening economic integration by reducing cross-border transaction costs, encouraging cross-border mergers, improving price transparency, increasing competition among member states, and eliminating exchange rate risk (Dominguez, 2006).

[5]The "convergence criteria" will be explained in detail in Chapter 2, where they partly represent the motivation of the research question.

[6]Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. Greece joined in 2002.

[7]Slovenia (2007), Cyprus (2008), Malta (2008), Slovak Republic (2009), Estonia (2011), Latvia (2014) and Lithuania (2015). Years in parentheses refer to the accession date.

[8]This theoretical framework will be fully explored in Chapter 2.

The European Central Bank (ECB) is the centrepiece of the euro area (De Grauwe, 2012). In 1999, the European Central Bank was created and took over monetary decision-making powers from national central banks. However, national central banks are involved in the decision-making process and carry out decisions in their national money markets. According to Article 105 of the Maastricht treaty, the primary objective of the European Central Bank is price stability, accompanied by economic growth as a secondary objective. Article 107 of the Maastricht treaty establishes the political independence of the European Central Bank. Seven years after its creation, Dominguez (2006) attributes some success to the ECB, but questions how well the euro will function when severe macroeconomic or financial shocks occur. As already mentioned, the European Central Bank is organized decentrally. It is interesting to note that the Federal Reserve System (FED) was initially organized decentrally as well. Yet it became highly centralized in the aftermath of the Great Depression (Wynne, 1999). Friedman and Schwartz (1963) claim that this initially decentralized organizational structure might have led to inappropriate and overly contractionary monetary policy decisions which prolonged the Great Depression. Dominguez (2006) recommends understanding the experience of the Federal Reserve System as a lesson for the European Central Bank.

O'Rouke and Taylor (2013) provide an extensive historical overview illustrating that the euro area substantially differs from previous currency unions. There are similarities to the United States, which has a *true* monetary union. However, the United States' monetary union was preceded by a political union which represents a major difference. In contrast, the architects of the euro area assumed political union to follow monetary integration (Bengsten, 2012). Moreover, the gold standard during the Bretton Woods system of monetary management was a series of country-by-country monetary regimes accompanied by independent national central banks, which also represents a clear distinction from the euro area.

The economic crisis in Europe, which will be discussed in the next sub-chapter, revealed structural and institutional weaknesses and the corresponding need for sound economic policies in euro area member countries (ECB, 2015).

1.2 Crisis and Responses

Despite the benefits of economic integration, Europe entered a severe crisis in the aftermath of the global financial crisis which emerged in the United States in 2007. The European epicentre of this crisis is the euro area and, in particular, its member countries in the periphery. Five European countries, namely Spain, Greece, Portugal, Ireland and Cyprus, had to rely on financial assistance between 2009 and 2015. In order to allow for financial assistance, the initial reaction to the crisis was to build two bailout institutions from scratch: the temporary European Financial Stability Facility (EFSF), followed by the permanent European Stability Mechanism (ESM). In addition, the European Central Bank implemented a range of new measures, such as for example the securities market program (SMP) in 2010, the outright monetary transactions (OMTs) in 2012 or the expanded asset purchase program (APP) in 2015.

Although the European crisis is often referred to as a European debt or European sovereign debt crisis, it is multifaceted. Bengsten (2012) describes the European crisis as a multiply overlapping and mutually reinforcing crisis, consisting of a fiscal crisis, a competitiveness crisis and a banking crisis. Another notable point is that the outbreak of the global financial crisis in 2008 triggered a reassessment among investors of the sustainability of the pre-crisis developments in the European periphery (Lane, 2012). This process began with a general reassessment of asset prices and growth prospects, but especially the pre-crisis development associated with macroeconomic imbalances in the European periphery called investors' attention. The severity of this crisis is well illustrated in a recent publication by Conesa and Kehoe (2014). Their contribution relies on the assumption that on outside party can put an end to

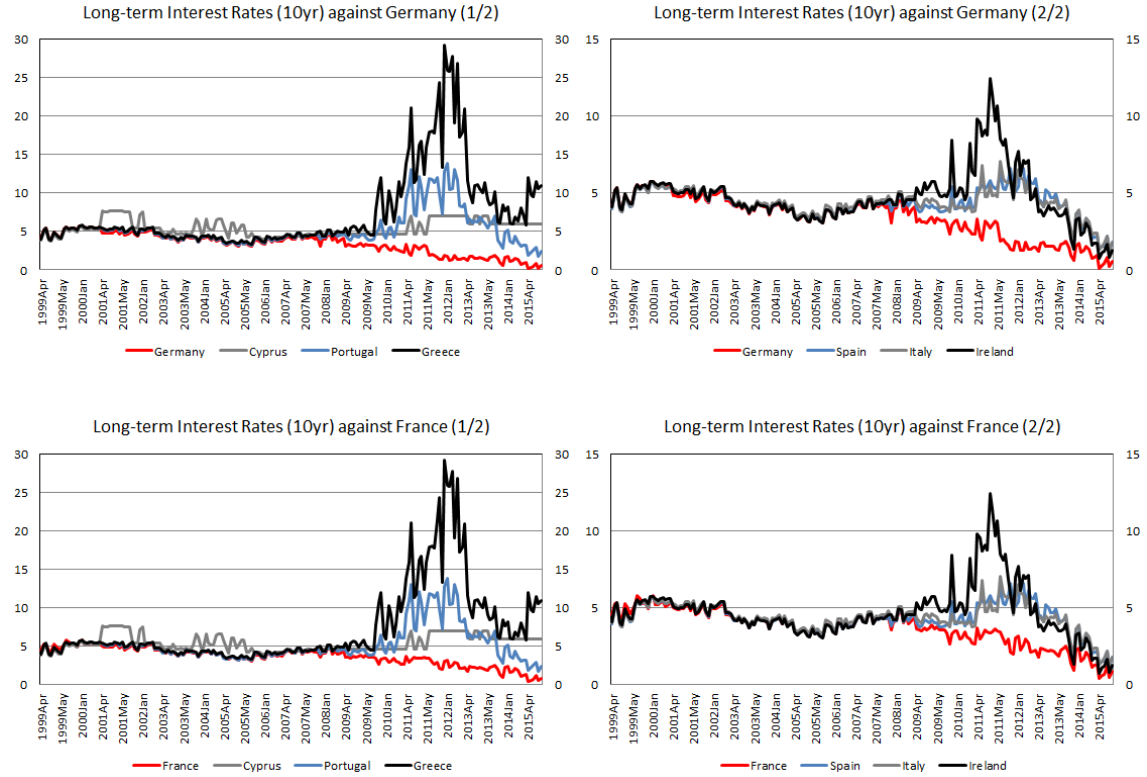
a sovereign debt crisis by executing a bailout which assures free lending at a penalty interest rate and good collateral. They focus on Portugal, Ireland, Italy, Greece and Spain. Conesa and Kehoe (2014) find that such a bailout, which worked for example in Mexico in 1995, is unlikely to work in Europe, since debt levels are so high that the bailout cannot provide sufficient incentives to reduce debt anymore.

In the following, I will summarize some of the key characteristics and causes of this crisis. This summary is not intended to be a complete analysis of the crisis, but it reveals to a large extent the motivation of this thesis. It is needless to say that my analysis of this crisis heavily benefits of hindsight.

1.2.1 Characteristics

I will start by looking at long-term interest rates, which are one of the most commonly used illustrations of the different developments among European countries in the aftermath of the global financial crisis and during the European sovereign debt crisis. German long-term interest rates are most commonly used as an European benchmark. In order to illustrate the severity of the crisis, I will also include France. France is economically in a less favourable condition than Germany, but still faces significantly lower long-term interest rates than the countries most hit by the crisis. Figure 1.2 plots long-term interest rates of Germany, France, Cyprus, Portugal, Greece, Spain, Italy and Ireland. Hence, it compares Germany and France, as the two largest economies in the EMU, with Italy and those five economies, which had to rely on financial assistance between 2009 and 2015.

Figure 1.2: Long-term interest rates in comparison for selected countries since 1999



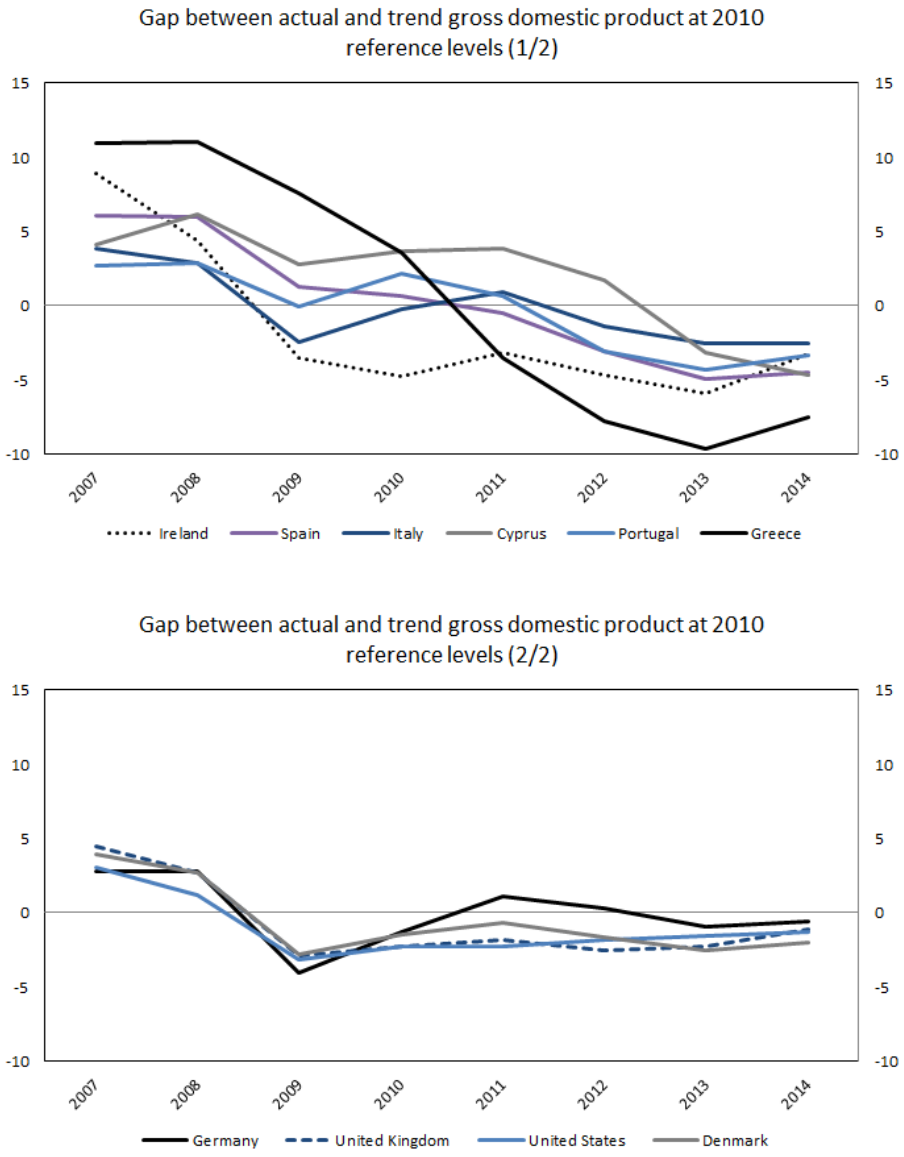
Source: ECB.

All graphs show that the beginning of the interest rate divergence coincides with the global financial crisis. However, the interest rate spreads peaked approximately between 2010 and 2012. Spreads were and are most pronounced for Greece, which reflects the severity of the crisis there. Interest rate spreads developed quite similarly for Portugal and Ireland - even though the latter is more an example of a banking crisis which transmits into a fiscal crisis, whereas the Portuguese crisis is considered to have its roots in public finances. Italy and Spain also experienced similar developments. Given that the latter formally requested financial assistance in July 2012, this shows that interest rate spreads do not fully reflect the severity of a crisis or the fundamentals of an economy, respectively. Cyprus, which submitted a request for financial stability support in June 2012, faced a development of interest rate

spreads similar to Italy and Spain. Although France is economically not as strong as Germany, it serves well as a benchmark. This shows that the interest rates of peripheral European economies did not only diverge from Germany. This illustration only includes the recent divergence in long-term interest rates. In contrast, during the run-up and first years of the single currency, there was considerable convergence of long-term interest rates. This convergence is often named as one of the reasons for the current economic crisis in Europe.

Figure 1.3 compares the changes of the output gap between actual and trend gross domestic product for selected countries and years. The lower panel of Figure 1.3 illustrates that EU countries such as Germany, the United Kingdom and Denmark exhibit a pattern very similar to the United States. These four very mature economies were all hit by the global financial crisis, but subsequently approached their economic potential again. This picture looks quite different in the upper panel for Spain, Greece, Portugal, Ireland and Cyprus. Italy, often said to be quite similar to this group, reveals a path more similar to Germany than the other countries in the upper panel. Greece is a special case, with a continuous decline in output gap since 2009. In the case of Spain, the decline in output gap is also a continuous process since 2008. Most European countries reveal an initial drop in output gap in 2008, which coincides with the global financial crisis, but also a second drop between 2010 and 2011, which coincides with the beginning of the European sovereign debt crisis.

Figure 1.3: Gap between actual and trend gross domestic product for selected countries and years



Notes:

(1) Gap between actual and trend gross domestic product at 2010 reference levels is measured in percentage of trend GDP.

(2) Source: Ameco.

(3) For the benefit of comparison, both graphs are scaled equally.

Figure 1.4: Unemployment rates (in %) EMU selected countries and years

(1) Source: Ameco.

(2) For the benefit of comparison, all graphs are scaled equally.

However, the European crisis is characterized by more than long-term interest rate divergence or different declines in output gap. Figure 1.4 compares unemployment rates in 2002 and 2012 for those twelve countries which adopted the euro between 1999 and 2002. The arithmetic mean of unemployment rates of these countries jumped from around 7% to above 11%. The unemployment rates of Austria and Belgium remain fairly unchanged. Germany is the only country where unemplyoment in 2012 is lower than in 2002. In Ireland, Portugal, Greece and Spain, the unemployment rates significantly increased from 2002 to 2012. In Spain and Greece, the unemployment rates are at approximately 25%. Additionally, this already very high unemployment is accompanied by even higher youth unemployment in Spain and Greece (O'Rouke and Taylor, 2013).

1.2.2 Causes

In Cyprus, Ireland and Spain, a banking crisis caused the economic collapse due to a vicious circle between banks and their sovereigns (O'Rouke and Taylor, 2013). The costs of bank bailouts deteriorated governments' fiscal positions, which in turn put further strain on banks' balance sheets, and so on. Whereas aggregated debt dynamics of the eurozone compared to the United States in the mid-2000s did not appear to be a looming problem, the developments at the individual country level evolved towards a severe fiscal crisis (Lane, 2012). And yet, in 2008 and largely in 2009, sovereign debt markets remained relatively calm.

Figure 1.5 compares general government gross debt as a percentage of GDP for selected countries since 1999. Since graphs are scaled differently, auxiliary lines colored in red are included. The first auxiliary line reflects a debt level of 60% relative to GDP which is a crucial threshold according to the Stability and Growth Pact. The second auxiliary line reflects a debt level which equals GDP.

The upper left panel of Figure 1.5 includes the five euro area countries which had to rely on financial assistance between 2009 and 2015, namely Spain, Greece,

Portugal, Ireland and Cyprus. The graph also includes Italy for the same reason as in Figure 1.3. It shows that Greece and Italy entered the single currency club with much higher levels of debt than Cyprus, Ireland, Portugal and Spain. Cyprus, Ireland and Spain are good examples of how the emergence of a banking crisis disrupts supposedly sustainable public finances. All three countries found themselves at debt levels below 60% in 2008. The sharpest acceleration in public debt took place in Ireland, where the banking crisis was also the most severe. In 2014, only Spain is at a level of debt which roughly equals economic output, whereas all other countries have debt levels considerably higher than their GDP.

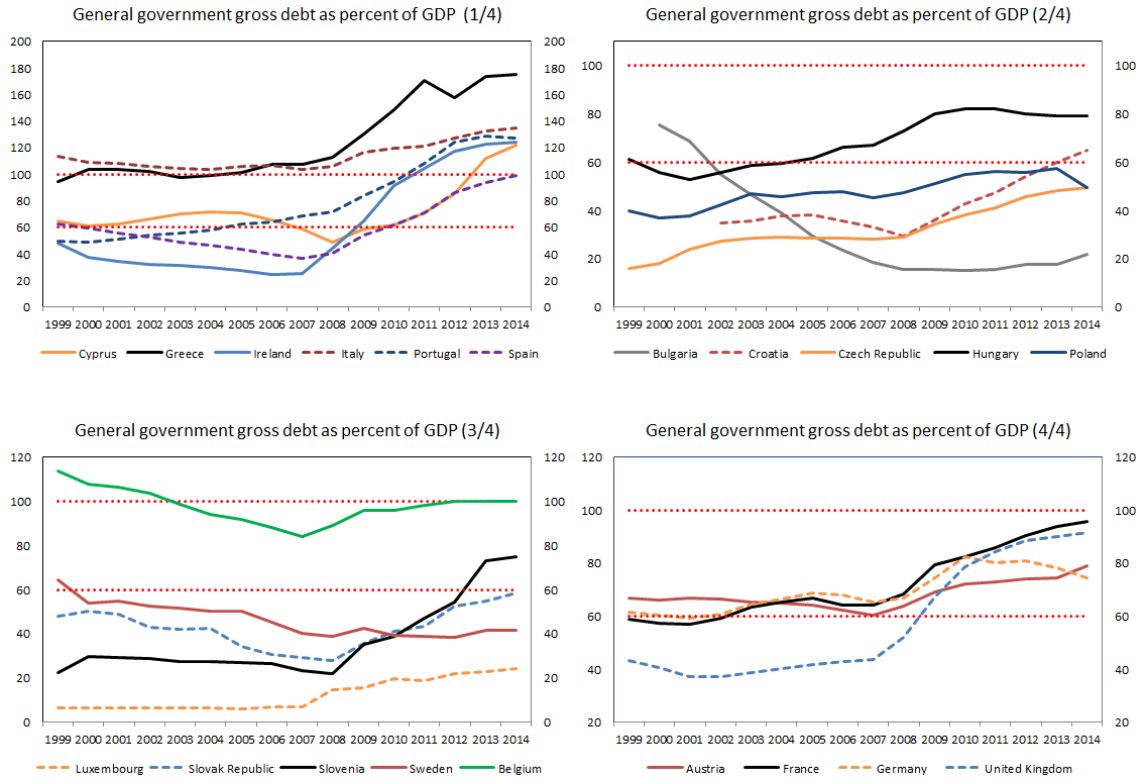
The upper right panel of Figure 1.5 shows the debt levels CEECs. Bulgaria is one of the few countries in Europe which significantly reduced its debt over the last couple of years and its debt level is at a fairly low level in 2014. Croatia, the Czech Republic and Poland increased their public debt since 1999 and are at a level of around 60% debt relative to GDP in 2014. The only country with public debt significantly above 60% relative to GDP is Hungary. Hungarian public debt levels have continuously increased between 2001 and 2010 and since then remained at around 80%.

The lower left panel of Figure 1.5 shows Belgium, Luxembourg and Sweden, three northern European countries, as well as two countries which joined the euro a couple of years after its introduction, namely Slovenia and the Slovak Republic. Sweden decreased its debt to GDP ratio from around 60% to around 40%, Luxembourg increased from an extremely low level of slightly below 7% to a still low level of slightly above 20%. In Slovenia and the Slovak Republic, public debt levels increased simultaneously with other member countries of the euro. However, the increase in debt to GDP in Slovenia was stronger and its debt level ranges at around 80% in 2014, which is 20 percentage points above the Slovak Republic. The Belgian banking system and correspondingly public finances were hit relatively hard by the crisis. The Belgian debt to GDP exhibits a U-shape over time and has stabilized at around 100% in recent years.

The lower right panel of Figure 1.5 includes Austria, France, Germany and United Kingdom. The graph shows that the debt levels and dynamics of Austria, France and Germany were quite similar until 2008. From 2008 on, Austria was subject to a much more modest but continuous increase in debt relative to output. Germany decoupled from France in 2010 and could even reduce its debt ratio after that. In 2014, debt to GDP of France was close to 100%, whereas it was slightly below 80% in Austria and Germany. Public debt relative to GDP in the United Kingdom started at a much lower level than in Austria, France and Germany in 1999. But the global financial crisis has accelerated British debt to GDP to close to 100% in 2014.

Admittedly, public debt alone does not provide a comprehensive picture without the inclusion of private debt. One may wonder, why Ireland and Spain ended in such trouble given their comparably low debt levels in 2007. Of course, domestic banking crises offer an answer. But these domestic banking crises were preceded by excessive credit growth in the private sector (Schularick and Taylor, 2012; Schularick, 2013; Jordà et al., 2013). This gives rise to the role of private debt. According to Schularick (2013) and Jordà et al. (2013), private debt is defined as the total lending of financial institutions to the private non-financial sector. The fact that aggregate debt levels have grown to historical highs was driven by an unprecedented accumulation of private debt (Schularick, 2013; Jordà et al., 2013). In advanced economies, private instead of public debt growth increases the probability financial stability risks (Jordà et al., 2013). If a banking crisis caused by high levels of private debt occurs, public debt increases due to automatic stabilizers and, in particular, bank bailouts (Reinhart et al., 2012). A causal chain which can be well observed in the public debt developments of Ireland and Spain.

Figure 1.5: General government gross debt as percent of GDP for selected countries and years



Source: IMF.

With a focus on the fiscal dimensions of the euro crisis, Lane (2012) identifies three sources of the relationship between the euro and the European sovereign debt crisis. Each source materialized in a different phase. First, there were incentives to take fiscal risks during the pre-crisis period due to the initial institutional design. Second, during the crisis, a flawed institutional design amplified the fiscal impact of the crisis dynamics. Third, there was a delayed and extended post-crisis recovery, due to the restrictions of a monetary union accompanied by a chaotic policy response and no institutions able to fight the crisis.

Another crucial development, which contributes to the severe crisis in Europe, are current account imbalances (Lane, 2012). In the pre-crisis phase, significant current

account imbalances accumulated, in particular between countries in the eurozone. However, current account imbalances are not economically undesirable in general. In a monetary union, current account imbalances could facilitate income convergence by channeling resources from capital-abundant high-income countries to low-income countries in need of capital (Blanchard and Giavazzi, 2002). In case current income is expected to be below future income, current account deficits could allow catch-up countries to smooth consumption (Lane, 2012). Nevertheless, there are risks and costs associated with current account imbalances. If capital inflows remain ineffective regarding productivity growth or delay the necessary adjustments to structural shocks, current account deficits impose macroeconomic risks (Blanchard, 2007; Giavazzi and Spaventa, 2011; Chen et al., 2012). In a monetary union, the potential misallocation of resources from tradables to non-tradables can be associated with a detrimental effect on medium-term growth, according to Blanchard (2007). Finally, reversals in capital flows increases the risk of a banking crisis (Lane, 2012). Capital flows are, among other reasons, also stimulated by country-specific issuances of sovereign debt (Brunnermeier et al., 2011): in boom phases, investors search for "yield" in the periphery and in a crisis, investors search for "safe havens" such as Germany. Hence, current account imbalances and the associated risk of reversals in capital flows are naturally linked to fiscal policy, since the mutualisation of sovereign debt (fiscal union) would mitigate this problem.

Table 1.1: Current account balance as percent of GDP

Framework		Country	1996-1998	1999-2001	2002-2004	2005-2007	2008-2011	2011-2014
European Union	Europena Monetary Union	Austria	-2.329	-1.074	2.179	2.826	3.664	2.049
		Belgium	5.243	5.098	3.689	1.910	-0.010	-1.610
		Cyprus	-2.245	-3.458	-3.681	-8.210	-12.058	-3.868
		Estonia	-9.382	-4.948	-11.072	-13.751	-1.190	-0.327
		Finland	5.063	7.157	6.495	3.924	1.967	-1.331
		France	2.170	2.118	0.837	-0.688	-1.464	-1.853
		Germany	-0.596	-1.008	2.850	6.256	6.174	7.269
		Greece	-4.403	-6.833	-6.278	-11.211	-12.075	-3.866
		Ireland	2.638	-0.252	-0.523	-4.127	-2.278	4.089
		Italy	2.575	0.363	-0.514	-1.218	-2.783	-0.887
		Latvia	-5.660	-7.153	-9.259	-19.204	-0.565	-1.815
		Lithuania	-9.934	-7.149	-6.534	-10.712	-3.102	-1.034
		Luxembourg	9.974	10.895	10.178	10.668	6.773	6.641
		Malta	-7.591	-6.364	-2.107	-7.397	-6.681	0.814
		Netherlands	5.028	2.849	5.271	7.819	5.615	9.770
		Portugal	-5.640	-9.785	-7.665	-10.370	-11.380	-2.834
		Slovak Republic	-9.106	-5.505	-7.203	-7.203	-4.315	0.290
		Slovenia	-0.043	-2.294	-0.787	-2.550	-2.025	3.383
		Spain	-0.497	-3.610	-4.006	-8.770	-6.314	-1.407
		Bulgaria	1.235	-5.288	-4.701	-18.131	-11.148	0.422
		Croatia	-7.707	-4.276	-5.781	-6.404	-5.114	0.094
		Czech Republic	-4.833	-4.003	-5.518	-2.478	-2.803	-2.098
		Denmark	0.399	2.150	2.982	2.894	4.040	6.175
		Hungary	-5.111	-7.506	-7.814	-7.386	-2.468	1.533
		Poland	-3.251	-5.535	-3.520	-4.154	-5.231	-3.389
		Romania	-6.308	-3.823	-5.839	-10.817	-6.708	-3.329
		Sweden	3.793	4.422	6.088	8.268	7.215	5.997
		United Kingdom	-0.355	-2.618	-1.904	-2.290	-1.684	-2.843

Notes:
(1) Deficits are colored in red.
(2) Source: IMF.

Table 1.1 illustrates the current account balances as a percentage of GDP for all EU member countries for selected time intervals. Some developments are noteworthy. Austria and Gemrany changed from deficits to surpluses, with the increase of German surpluses being comparably large. Conversely, Belgium, France and Italy developed from surpluses to deficits. Only Luxembourg and Netherlands constantly exhibited current account surpluses. Estonia, Latvia, Lithuania, Slovenia and Slovak Republic, who all joined the currency club at a later stage, could reduce their deficits considerably. Slovenia and Slovak Republic even achieved a change from a deficit to a surplus. Cyprus, Greece, Portugal and Spain consistently generated current account deficits. These deficits peaked between 2005 and 2011, most pronounced in Cyprus,

Greece and Portugal. Ireland entered the euro area with a surplus, followed by many years with a deficit, but reversed back to a surplus recently, which is another example of how its situation was structurally different from the situation in Cyprus, Greece and Portugal. Excluding the most recent time period, Finland always achieved a current account surplus. Regarding those states that are members of the EU, but not part of the eurozone, Denmark and Sweden achieved permanent surpluses. The CEECs faced mainly current account deficits, most pronounced in Bulgaria between 2005 and 2011 and in Romania between 2005 and 2007. The United Kingdom showed moderate current account deficits over the whole time period.

1.2.3 Responses

Bengsten (2012) claims that the European crisis is the result of a failure in institutional design, but assumes the completion of the original concept of a comprehensive economic and monetary union as a response. With respect to the institutional design, Bengsten (2012) argues that the solution to Europe's problems is additional integration in the form of a banking, a fiscal or perhaps even a full political unions.[9] However, these measures cannot be addressed in isolation due to the interdependencies between banking union, fiscal union and political union (Véron, 2012). For example, a banking union requires fiscal backing. In a similar vein, Sapir (2011) argues that the greater the extent of market integration, the greater the need for policy integration is likely to be.

Not all measures in response to the crisis are set yet, some are still on the agenda and to see the results of policy responses will take time. As mentioned in the beginning, the history of economic and currency unions outside of Europe does not provide transferable solutions, and yet, the short history of a unified Europe gives hope. As illustrated by Bengsten (2012), Europeans have resolved many crises that have threatened the project of European integration. Sapir (2011) provides an ex-

[9]The creation of a European banking union represents the economic motivation for Chapter 5 and 6, whereas fiscal policy partly motivates Chapter 2.

ample, which is the single market program, launched in 1985 as a response to the "Euro-sclerosis" threatening European integration in the form of low growth and unemployment in the early 1980s.

1.2.3.1 Financial Integration

The need of banking and financial stability within a monetary union belongs to the most important issues neglected by OCA theory (Obstfeld, 2013), but considered as essential for the euro area (O'Rouke and Taylor, 2013; Lane, 2012; Brunnermeier et al., 2011).

In the aftermath of the global financial crisis, which peaked in 2008, regulatory authorities have put a lot of attention to a reform of the regulation of capital requirements for banks (Hellwig, 2010). In December 2010, the Basel Committee on Banking Supervision published a comprehensive set of reforms. This set of reforms aims at strengthening the regulation, supervision and risk management of the banking sector, known as Basel III. Main changes in Basel III are reflected in the fields of capital requirement, risk coverage, leverage ratio, and liquidity. In addition, the introduction of the non risk-weighted leverage ratio gained popularity. This reflects the criticism regarding potentially flawed model-based approaches. In Germany, as in other EU countries, the recommendations of the Basel Committee on Banking Supervision will be implemented via the Capital Requirements Directive IV (CRD IV) and the Capital Requirements Regulation (CRR). In Germany, these reforms are accompanied by the German restructuring law (Schäfer et al., 2013).

Another important part of future financial integration is the European Banking Union. The term banking union is most conveniently explained by Véron (2012):

"The expression banking union is used here to refer to a policy framework that locates key instruments of banking policy at European level to enable the formation and maintenance of an integrated European banking system."

The European Commission conducted different policy measures in order to restore the safety and soundness of the financial sector in Europe in June 2012.[10] This toolbox shall allow for crisis prevention, early intervention and bank resolution. A single rulebook was created which applies to all financial actors in the European Union. This single rulebook represents the foundation of the banking union, which ought to result in deeper integration of the banking system. The banking union is also intended to break the vicious circle between sovereign and banking credit conditions (Lane, 2012). The banking union applies to countries in the eurozone, whilst other EU countries can also join. At the heart of the banking union lies the Single Supervisory Mechanism (SSM) and the Single Resolution Mechanism (SRM). The impartial supervision by the European Central Bank aims at making bank failures less likely. The incorporation of banking supervision extends the initial duties of the European Central Bank. The Single Resolution Mechanism shall assure that banks can be resolved more easily and with less taxpayers' money.

The political discussion about the implementation of a banking union has been associated with the question to which banks the uniform rules and supervision should be applied. According to Pisani-Ferry et al. (2012), there are two corner solutions. First, a partial banking union which covers only systemically important financial institutions. Second, a complete version which covers all banks in Europe. In particular in Germany, there was strong resistance against this by saving banks and cooperative banks, which argued that a banking union represents a competitive disadvantage for them. In contrast, the Deutsche Bank as the largest German private Bank mainly lobbies against the non risk-weighted leverage ratio part of Basel III.

This shows that the discussion implies a need to understand the country-specific characteristics of the EU countries' banking systems.

[10] See for this and the following EC (2015) - European Commission webpage: $http://ec.europa.eu/finance/general-policy/banking-union/index\_en.htm$.

1.2.3.2 Fiscal Integration

There are many ideas of how a fiscal union or a mutualization of fiscal policies in the European Union could look like. Practically, the recent crisis in Europe clearly emphasizes the need for sustainable public finances. Theoretically, sustainable public finances are important as well. According to Lane (2012) the mutlitple equilibria problem may have greater force in a monetary union.

The first amendment of fiscal policy in the aftermath of the global financial crisis was the implementation of the European Fiscal Compact in 2013. The European Fiscal Compact requires that countries embed the associated fiscal rules into national legislation. The reforms are based on two principles (Lane, 2012). First, high public debt makes countries more prone to fiscal instability. Second, the fiscal balance ought to be close to zero "over the cycle". Correspondingly, the new fiscal rules focus more on the structural budget balance. This allows to adjust for cyclical effects and one-offs. This new set of rules is supposed to provide an incentive for countercyclical fiscal policy (Lane, 2012). However, Lane (2012) identifies two problems associated with the European Fiscal Compact. First, the focus on the structural budget balance exposes the new rules to measurement errors. Second, responses to structural budget imbalances are national.

O'Rouke and Taylor (2013) propose a eurozone-wide safe bond to break the vicious feedback loop between national banking systems and national sovereigns; for the same purpose, Lane (2012) proposes "eurobonds" in combination with a banking union. Such a supposedly safe eurozone asset could facilitate sovereign debt default or restructuring without strains on a country's financial system or eurowide contagion. Eurobonds rely on the mutualisation of government debt across Europe. Of course, such a mutualisation of different credit risks opens the door to moral hazard. To counteract this, limiting eurobonds' maturities to the short term or limiting volumes

to, for example, a debt to GDP level of 60% are options discussed in the literature (Delpla and von Weizsäcker, 2011; Philippon and Hellwig, 2011).

In a similar vein, Brunnermeier et al. (2011) propose European Safe Bonds (ESBies). Interestingly, they propose this new safe asset not only from a European fiscal perspective: they argue that the global demand for safe assets combined with the lack of supply of such assets is one reason for the gobal financial crisis, but also a chance for Europe. However, the major distinguishing feature of their proposal is the way they envision a European Safe Bond to be constructed. According to Brunnermeier et al. (2011), European Safe Bonds are securities issued by a newly installed European Debt Agency. These bonds represent a senior tranche of a portfolio of sovereign bonds issued by European countries and held by the European Debt Agency. They do not require further fiscal integration but would benefit from the price stability target of the European Central Bank.

1.3 Motivation

The motivation of this thesis is twofold. There is an economic and a methodological motivation. To sum it up, in the broad field of European integration relevant research questions are identified and addressed. By employing microeconomic-data to address the majority of these macroeconomic research questions, my work is also methodologically relevant.

1.3.1 Economic Motivation

The general introduction has already made parts of the economic motivation for specific research questions obvious. However, all research questions addressed will be motivated and explained separately in each chapter of this work. The whole work aims at providing a clearer picture of the economics of European integration and at identifying further steps to enhance economic integration. Since European economic integration is manifold, I will address a diverse range of research questions related

to this phenomenon. Needless to say that none of the research questions I address here have been addressed in the literature so far.

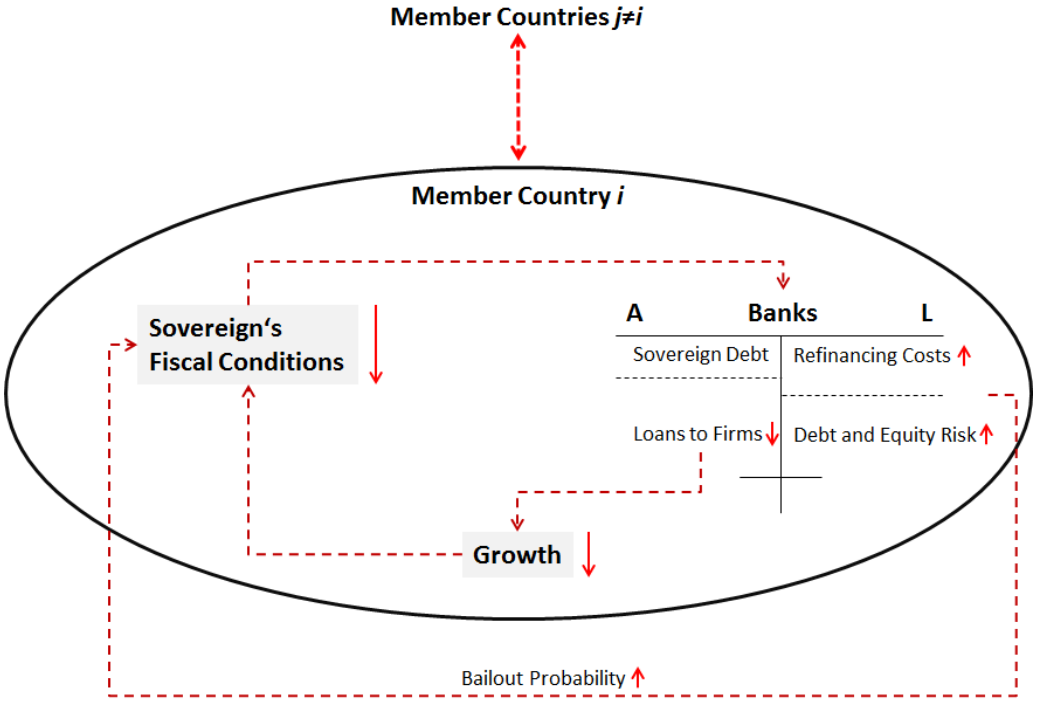
1.3.1.1 Theoretical Motivation

The interaction between fiscal policy and banks, referred to as the vicious circle between sovereigns and banks, has already been mentioned. This interaction represents the centrepiece of motivation of the selected research questions. Normally, this vicious circle between sovereigns and banks is emphasized at the country-specific level. However, there is natural interaction of countries within the European Union and, in particular, within the euro area. One sovereign's fiscal conditions, like in the case of Greece, can easily threaten the remaining countries.

Figure 1.6 illustrates the interaction of a sovereign's fiscal conditions, banking system and growth.[11] Chapters of this thesis relate to or are motivated, respectively, by one of these components. Given the lack of regulatory discrimination among bonds (Brunnermeier et al., 2011), banks hold large amounts of their sovereigns' debt. Let us assume that the circle starts with worsening fiscal conditions of the sovereign. Banks' sovereign debt holdings increase bank risk and, in turn cause higher refinancing costs for banks. Facing both more expansive refinancing conditions and more risk, banks reduce loans to firms. The impaired financing conditions of firms reduce growth, which in turn reduces the sovereign's tax revenues. The sovereign's fiscal conditions further deteriorate, given lower tax revenues and the increasing probability of bank bailouts. According to previous regulations, there was no discrimination between the bonds of different EU member countries. However, there was still *de facto* currency risk in many cases, since not all member countries of the European Union are part of the euro area. Nevertheless, this circle is not country-specific. Fiscal conditions of one country or the fragility of this country's banking system create the risk of contagion. Once this vicious circle gains momentum in one country, it can transmit into another country.

[11] Figure 1.6 is closely related to illustrations mady by (Brunnermeier et al., 2011).

Figure 1.6: Circle between sovereigns and banks



1.3.1.2 Economic Policy Motivation

Understanding the euro area as the final stage of integration within the European Union framework is why I devote a considerable amount of work to questions related to the euro area. The idea of a fiscal union emphasizes the role, fiscal policy plays for euro area member states and for the functioning of the currency area. I will shed some light on the connection of fiscal policy and the functioning of the euro area in the second chapter of this work. The third chapter is also closely related to the euro area. Reserve currencies are held in significant quantities by governments and institutions and are characterized by their international role in trade-settlement and their perceived safe value. Wyplosz (1997) describes Europe's desire to create the world's premier currency as a publicly understated part of the motivation of the euro. According to Dominguez (2006), there was a belief that the euro could surpass the dollar as the world's international reserve currency. Chinese exchange rate management provides an opportunity to empirically assess the role of the euro

as an international currency. This second research question also relates to the first research question, since Europe does not offer a safe asset (for example, European Safe Bonds) which could rival United States Treasuries (Brunnermeier et al., 2011). Such a safe assets is supposedly required for a reserve currency.

The role both institutions and institutional harmonization play in the context of European integration is indisputable. The resolving of insolvency represents an important tessera of a market economy. Yet, there are substantial differences in institutional quality in terms of resolving insolvency frameworks across EU countries. In Chapter 4, the role of institutional quality in terms of resolving insolvency is illustrated and the potential need to increase institutional quality in CEECs is emphasized. This chapter also provides insights for further convergence of CEECs.

A general consensus in academia exists regarding the need of a banking union within the European Union. In June 2012, the European Commission paved the way for the implementation of a banking union. In addition, EU countries implemented Basel III through a new legislative package (Capital Requirements Directive). Different measures will be introduced stepwise until 2019. However, cross-country regulation also requires country-specific knowledge. This motivates me to conduct two studies related to the German banking market, which are represented in Chapter 5 and 6. The first study in chapter 5 is motivated by the need to understand how an EU-wide regulatory change could affect the German economy. The regulatory change relates to Basel III. Looking at the prospect of a European Banking Union in the future, in Chapter 6 relationship banking, a characteristic very specific to the German banking market, is explored and its determinants are revealed. Blanchard (2004), with respect to the economic future of Europe, emphasizes the importance of economic and social relations between firms and suppliers of funds. Relationship banking represents both economic and social relations between firms and banks. Even though these two chapters focus on Germany, given the similarities of bank-based

systems such as in Germany and other European countries, both chapters provide results that are also relevant beyond their direct interpretation for Germany.

1.3.2 Methodological Motivation

In addition to the pure economic motivation, my thesis is also methodologically motivated. In general, I use innovative empirical methods in order to address economically relevant questions. Economists have witnessed a considerable increase in the availability of micro-data during the last couple of years (as of summer 2015). Making use of detailed micro-data in addressing macroeconomic issues is important and brings the possibility of implementing new empirical methods in macroeconomics. This methodological development is well illustrated by the fact that the American Economic Review published papers related to the topics "Big Data in Macroeconomics: New Insights from Large Administrative Datasets"[12] and "Macro Development with Micro Data"[13] in May 2014. In a similar vein, the Journal of Economic Perspectives published the "Symposium: Big Data"[14] in Spring 2014. Both are top journals and their emphasis on this methodological development more than underlines its importance for the whole profession of economics.

Making use of micro-data is the major technical motivation of my work. In Chapter 2, I employ standard macro-data but I use a panel estimator, which is the method mainly used in my thesis. In Chapter 3, daily exchange rate data are used. In Chapter 4, 5 and 6, I use microeconomic data. Thus, in 3 out of 5 studies presented here, I use micro-data, but provide macroeconomically relevant results. With respect to the use of micro-data in macroeconomics, my work provides methodologically state of the art research in economics.

From a methodological point of view, Chapter 4 and 5 represent the centrepiece of this thesis. Both chapters make use of large micro-data sets. Chapter 4 includes

[12] See Chetty et al. (2014), Guvenen et al. (2014) and Kreiner et al. (2014).
[13] See Buera et al. (2014), Gollin et al. (2014) and Kaboski et al. (2014).
[14] See Varian (2014), Belloni et al. (2014), Nickerson and Rogers (2014) and Heffetz and Ligett (2014).

micro-data for more than 10 European countries between 2005 and 2012. In Chapter 5, two micro-data sets are combined and employed using multilevel regressions.

1.4 Outline of the Thesis

This thesis includes five research papers. Each research paper represents a chapter. A set of research questions is addressed separatly:

1. Are the "convergence criteria", defined by the Maastricht treaty and the Stability and Growth Pact, linked to the theory of optimum currency areas by aligning demand shocks among euro area member states? Do new euro area member countries play a different role?
2. What role does the euro play as an international currency? What is the composition of the secret currency basket used by the Chinese central bank to manage the Chinese yuan?
3. Do more efficient institutions in terms of resolving insolvency ensure a more efficient use of assets in the economy? How could a narrow channel through which institutions potentially affect income per capita in the long-run look like?
4. What are the possible effects generated by tighter capital requirements for banks due to Basel III on the German economy? Do such regulatory changes transmit differently into different industries?
5. What determines relationship banking in a bank-based system like in Germany? How does this relate to standard capital structure theory?

In the following, the treatment of each of these research questions will be presented as a separate paper in Chapters 2, 3, 4, 5 and 6 of this thesis. For each paper, I will provide short background information. Finally, in chapter 7, I will give a summary of my work and derive policy recommendations embedded in the overall topic of European integration.

Chapter 2

Determinants of Demand Shock Synchronization in the EMU

2.1 Abstract and Details of the Article

2.1.1 Abstract

The impact of selected variables on bilateral demand shock synchronization among euro area member states is analyzed. Compliance to the "convergence criteria" is introduced as a binary variable to assess whether there is an indirect connection between these criteria and the theory of optimum currency areas. The results provide weak evidence that bilateral trade linkages decrease bilateral business cycle deviation. For new member states, fiscal policy is more important. With respect to economic integration, new member states' accession path has to be taken into account and it is recommended to overachieve fiscal rules prior to a new member's entry into the eurozone, in order to retain some flexibility.

JEL Classifications: E32, E42, C32, C33.

2.1.2 Details of the Article

This article is my single-author paper.[1] I presented it at the following conferences:

- Falling Walls Lab, Berlin/ Germany, November 2012.
- Political Economy of Eurozone Crisis: Is Fiscal Union Feasible?, Brno/ Czech Republic, November 2012.
- INFER International Workshop on European Economic Integration: Present and Future Challenges, Lisbon/ Portugal, June 2014.

2.2 Introduction

The theoretical assessment of whether a country is suitable for a monetary union is provided by the Optimum Currency Area (OCA) theory. Based on OCA theory, a sufficient degree of business cycle synchronization is required for economies to constitute an optimum currency area. Ex ante this decision might be biased, due to the endogeneity of the criteria. But even when countries have already merged into a monetary union, asymmetric shocks can still appear, as the recent history of the euro area proved. Hence, ex post the matter of interest is rather skewed towards the question of whether a monetary union is a sustainable framework. Since the less business cycles deviate among member states, the more sustainable a monetary union is, the determinants of business cycle synchronization among member states are of high interest. In particular, variables which might cause bilateral demand shock deviation or synchronization, respectively, need to be identified and examined empirically for their influence.

As can be seen from the Maastricht treaty and the Stability and Growth Pact ("convergence criteria"), which were put into place by European politicians specifically to assure a sustainable framework, fiscal policy is unambiguously of high interest

[1]I would like to thank Jarko Fidrmuc, Jesus Crespo Cuaresma, Viktor Winschel, Philipp Schreiber and the participants of several conferences for helpful comments and discussions.

and generally acknowledged as an important factor in a monetary union (De Grauwe, 2012). The important role of fiscal policy is highlighted by the decision to implement the so called European Fiscal Compact and the ongoing academic debate (Sly and Weber, 2013; Agnello et al., 2013; Alesina et al., 2012; Alesina and Ardagna, 2012; Reinhart et al., 2012). The role of fiscal policy in the euro area is also visible from the sovereign debt crisis, characterized by excessive debt in some countries, in particular in the periphery. In general, facing a one-fits-all monetary policy makes fiscal policy an even more important tool for national governments to steer the economy (Crespo Cuaresma et al., 2011). Additionally, it is easy to imagine that there is a considerable probability of future fiscal shocks related to demographic developments, such as increasing government expenditures due to pension liabilities. There are simple reasons why fiscal discipline is favorable in the long term: reasonable expenditures ought to improve the allocation of financial resources and lower interest rates ought to stabilize inflation expectations (Babetski et al., 2003).

The research question here is if and how fiscal policy is linked to the theory of optimum currency areas. To be precise, does a common fiscal discipline such as the convergence criteria align demand shocks among eurozone member states? It is well understood that there are important factors for a sustainable monetary union other than demand shock synchronization. However, to address the question of whether there is a linkage between the convergence criteria and demand shocks has been omitted from the literature so far. Yet, after more than one decade of the euro, the data to address this question is now certainly available. A potential linkage between the convergence criteria and demand shocks can be interpreted as an indirect connection of fiscal policy and OCA theory. It is indirect since the convergence criteria lack a sound economic foundation (Wyplosz, 1997) but intend to provide an outcome which is theoretically desirable according to the OCA theory.

The present paper finds that bilateral trade linkages weakly increase bilateral business cycle synchronization among member states of the euro area and that in case of

new memeber states there is an indirect connection between the convergence criteria and the theory of optimum currency areas. I understand an indirect connection as fiscal rules which assure business cycle synchronization.

To identify bilateral business cycle synchronization among euro area member states, I decompose business cycles into demand and supply shocks. Demand and supply shocks reveal that the financial crisis at its peak hit member countries asymmetrically. In line with most of the OCA literature this paper's focus lies on demand shocks. Business cycle asymmetries make a centralized monetary policy to come at higher costs. Since aggregating demand shocks among euro area member states might be associated with losing some information, demand shock deviation among euro area member states is measured bilaterally and time varying. Thus, bilateral business cycle synchronization is measured as the modulus between demand shocks of two euro area member states.

Whereas the bulk of the existing literature dilutes the time dimension by averaging over periods, this paper takes the time-varying nature of shocks explicitly into account by using the modulus between two countries for each period. In a panel regression of bilateral business cycle synchronization on selected macroeconomic variables, the coefficients of bilateral trade linkages between two countries take on the hypothesized sign and enter the panel regression through most specifications statistically significantly. Higher trade integration reduces the asymmetry of demand shocks between euro area member states. A binary variable designed to reflect compliance with the convergence criteria turns out to have no impact on bilateral business cycle deviation in general, but it has a statistically significant impact with the hypothesized sign when applied solely to new member countries.

To address the question of which variables cause bilateral demand shock synchronization or deviation, respectively, and what role a common fiscal discipline plays, a set of variables is empirically employed. The paper contributes by explicitly taking bilateral measures into account. Hence, this study will contribute to the discussion

regarding the role of a common fiscal discipline in the euro area. It contributes to our understanding of why business cycles differ among member states. Finally, it provides empirical insight regarding further economic integration in the euro area. This paper relates to at least two strands of literature. Firstly, the theory of optimum currency areas in a broader sense. Secondly, the role of fiscal policy in a narrow sense, since solely measures related to the eurozone are taken into account.

2.3 Literature Review

2.3.1 Theory of Optimum Currency Areas

Mundell (1961) finds, based on the appearance of an asymmetric demand shock, that an optimum currency area is a territory characterised by high internal labour mobility and low external labour mobility. McKinnon (1963) argues that small and highly open economies shall merge into a single-currency area until they constitute a currency area which is sufficiently large to float against other currency areas. Kenen (1969) identifies product diversification as a necessary precondition to join a monetary union. Ingram (1969) criticizes that the optimum size of a currency area is not attributable to real economic determinants and emphasizes the practical need of integrated capital markets. Fleming (1971) argues that different countries may prefer different points along the Phillips curve or different ratios of inflation and employment, respectively. Vaubel (1976) introduces the real exchange rate as another criterion, since countries using their nominal exchange rates as mechanisms of adjustment or those which experience high real exchange rate changes are no candidates for a currency union.

As to the question of whether an economy is suited to enter a monetary union, different OCA-criteria could easily provide conflicting answers (Matthes, 2009). Hence, the OCA-criteria lead to a cost-benefit analysis, where costs arise mainly on the macro-level and benefits are seen mainly on the micro-level. The symmetry of shocks implies that countries which experience similar shocks and aligned business cycles,

respectively, fit best for a common currency or they at least could give up monetary authority at the lowest costs. Hence, a methodology to recover economic shocks is required. Structural vector autoregression (SVAR) was initially developed to decompose the influence of demand and supply shocks on output and unemployment assuming that both shocks are uncorrelated (Blanchard and Quah, 1989). Bayoumi and Eichengreen (1994) adapted structural vector autoregression to the needs of the OCA theory (Kenen, 2000), in order to identify demand and supply shocks and separate them from the corresponding response. Based on a Keynesian long-term framework, it is assumed that demand shocks affect output only temporary and that supply shocks have a permanent effect on output. However, both affect the price level in the long-run. These restrictions make it possible to separate exogenous shocks from their endogenous response.

2.3.2 Endogeneity

When considering the introduced OCA criteria as the foundation of making a decision whether to join or create a currency area, the idea of endogeneity plays an important role and represents a major limitation to the approach of applying the OCA criteria to define an optimum currency area *ex ante*. The argument of endogeneity was introduced into OCA theory by Frankel and Rose (1998), who understand their work as a simple application of the "Lucas Critique", which in this context leads to the conclusion that historical data cannot be used to judge on a country's suitability to join a monetary union due to the endogeneity of the criteria. They find strong empirical evidence of a positive relationship between the degree of bilateral trade intensity, which increases significantly once a country has joined a monetary union, and the cross-country bilateral correlation of business cycles. A more recent study is provided by Baxter and Kouparitsas (2005) and shows that bilateral trade is a robust determinant of business cycle comovement. In addition to the initial hypothesis by Frankel and Rose (1998), Matthes (2009) names two more potential endogeneity factors related to the eurozone: (1) The influence of the euro

area on structural reforms, which could enhance product and labour market flexibility; (2) fiscal policies, in particular the Stability and Growth Pact (SGP), which could theoretically make shocks more symmetric. Analysing endogeneity with regard to the euro area, Willett et al. (2010) and Matthes (2009) do not clearly support the argument of endogeneity, whereas Boewer and Guillemineau (2006) as well as Gouveia and Correia (2013) support the argument of endogeneity. Fidrmuc (2004) modifies the prediction of Frankel and Rose (1998) of business cycles getting more correlated by emphasizing the role of intra-industry trade; Babetskii (2004) supports endogeneity considering demand shocks. Finally, Willett et al. (2010) offer a useful limitation regarding measurement: he notes that it is not always easy to distinguish between the effects of EU-wide initiatives and the effects of the euro itself. The European Union and the euro area are, to some degree, different policy frameworks, but have a lot of overlapping issues at the same time.

2.3.3 Convergence Criteria

Together with a common monetary policy, the convergence criteria represent the main feature of the policy framework in the euro area. In order to take into account the characteristics of transition economies, Babetski et al. (2003) emphasize that the Maastricht criteria must be applied to "comparable economies". Baskaran (2009) aims to investigate the causal impact of the Maastricht treaty on several macroeconomic variables and concludes that the belief of the Maastricht treaty's supporters, namely that it would lead to sustained improvement of fiscal balances and macroeconomic stability in the eurozone, was wrong. Jonas (2006) argues that potential member countries should overachieve the fiscal rules already some time prior to their final accession, in order to be equipped with some flexibility when joining the monetary union. Barrell and Sefton (1997) find that the Maastricht criteria are generally contractionary with regard to output and employment in the short to medium term. Sargent and Wallace (1981) illustrate the importance of fiscal policy with regard to inflation. They suggest that, under certain circumstances, monetary

policy will increase inflation, depending on the assumptions about either current or future inflation and given that the fiscal authority runs a persistent deficit.

2.3.4 Fiscal Policy and Business Cycle Synchronization

Crespo Cuaresma et al. (2011) find that once a high degree of trade integration is reached by countries involved in the European integration process, the role of fiscal policy is particularly relevant. They stress the fact that the conduct of monetary policy by the ECB is a potential source of asymmetric shocks in the euro area, due to the heterogeneity in monetary transmission mechanisms. But they still consider the main problem to be asymmetric shocks themselves, as suggested by Mundell (1961), rather than the asymmetric transmission of common shocks. In order to measure business cycle synchronization, they decompose GDP series into an unobservable trend and a cyclical as well as an irregular component; they then use the (smoothed) cyclical component to analyze the degree of synchronization of one country with a whole set of countries. The standard deviation of the smoothed cycles is used to indicate synchronization.

Darvas et al. (2005) pose the question of whether there is an indirect connection between the convergence criteria, in particular fiscal variables, and the most important optimum currency area criterion, namely business cycle synchronization. They show that persistent cross-country differences in government budget positions tend to lower the synchronization of business cycles. The resulting inference is that – whether intended or not – the application of the convergence criteria brought euro-zone entrants closer to an optimum currency area. The intuition of the contribution is straightforward: fiscally irresponsible countries create idiosyncratic fiscal shocks. Hence, more fiscal discipline reduces the scope of idiosyncratic fiscal shocks. Darvas et al. (2005) use correlations between two countries of different business cycle measures as the dependent variable in their panel and employ fiscal divergence according to Frankel and Rose (1998) as the independent variable. Using the same cyclically adjusted fiscal deficit measure like Darvas et al. (2005) in a different empirical frame-

work, Artis et al. (2008) find that fiscal divergence causes less synchronized business cycles.

2.4 Data

The initial intention was to exercise the empirical analysis for all current euro area member states. The data sources presented in Table 2.1 were used to obtain the relevant data for all countries. Due to a lack of availability in bilateral trade data, Cyprus and Malta need to be excluded from the analysis. Latvia is excluded from the analysis since it entered the euro area too recently. Data until the end of 2012 are used, mainly because 2013 the European Fiscal Compact came into effect meaning that fiscal rules have changed since then.

For the structural VAR approach preliminary treatment of the data is required. To check for stationarity, the Augmented Dickey-Fuller test (ADF) is employed. Given the methodology, time series of real GDP and GDP-deflator ought to be integrated of order one, I(1). Robust evidence is obtained that all time series are non-stationary in levels but stationary in first differences of the natural logarithm (see Table 2.2).

Table 2.1: Data & Sources & Sample Periods

Variable	Government Deficit & Surplus	Government Debt/GDP	Consumer Price Index	Producer Price Index	International Trade	Real GDP	GDP-Deflator	Current Account/GDP
Source	ECB	Eurostat	OECD	OECD	OECD	OECD	OECD/IFS	OECD
Frequency	Quarterly	Quarterly	Monthly	Monthly	Monthly	Quarterly	Quarterly	Quarterly
Austria	1999Q1-2012Q3	2000Q1-2012Q4	1989M12-2012M12	2000M1-2012M12	1998Q4-2012Q4	1989Q3-2012Q4	1989Q3-2012Q4	1992Q1-2012Q3
Belgium	1999Q1-2012Q3	2000Q1-2012Q4	1989M12-2012M12	1994M1-2012M12	1998Q4-2012Q4	1995Q1-2012Q3	1995Q1-2012Q3	1995Q1-2012Q3
Estonia	1999Q1-2012Q3	2000Q1-2012Q4	1998M1-2012M12	2002M1-2012M12	2007Q1-2012Q4	1995Q1-2012Q3	1995Q1-2012Q3	1995Q1-2012Q3
Finland	1999Q1-2012Q3	2000Q1-2012Q4	1989M12-2012M12	1994M2-2012M12	1998Q4-2012Q3	1990Q1-2012Q3	1990Q1-2012Q3	1989Q4-2012Q4
France	1999Q1-2011Q4	2000Q1-2012Q4	1989M12-2012M12	1994M2-2012M12	1998Q4-2012Q4	1989Q4-2012Q3	1989Q4-2012Q3	1995Q1-2012Q4
Germany	1999Q1-2011Q4	2000Q1-2012Q4	1989M12-2012M12	1994M1-2012M12	1998Q4-2012Q4	1991Q1-2012Q4	1991Q1-2012Q4	1989Q4-2012Q4
Greece	1999Q4-2012Q3	2000Q4-2012Q4	1989M12-2012M12	1994M1-2012M12	1998Q4-2012Q3	1996Q4-2012Q3	2000Q1-2011Q1	2000Q2-2011Q1
Ireland	1999Q1-2012Q3	2000Q1-2012Q4	1989M12-2012M12	1994M1-2012M12	1998Q4-2012Q4	1997Q1-2012Q3	1997Q1-2012Q3	1990Q1-2012Q3
Italy	1999Q1-2012Q3	2000Q1-2012Q4	1989M12-2012M12	1994M1-2012M12	1998Q4-2012Q4	1991Q1-2012Q4	1991Q1-2012Q4	1990Q1-2012Q3
Luxembourg	1999Q1-2012Q3	2000Q1-2012Q4	1989M12-2012M12	1994M1-2012M12	1998Q4-2012Q3	1995Q1-2012Q3	1995Q1-2012Q3	1995Q1-2012Q3
Netherlands	1999Q1-2012Q3	2000Q1-2012Q4	1989M12-2012M12	1994M1-2012M12	1998Q4-2012Q4	1989Q4-2012Q4	1989Q4-2012Q4	1989Q4-2012Q3
Portugal	1999Q1-2012Q3	2000Q1-2012Q4	1989M12-2012M12	1994M1-2012M12	1998Q4-2012Q3	1995Q1-2012Q4	1995Q1-2012Q4	1996Q1-2012Q3
Slovak Republic	1999Q1-2012Q3	2000Q1-2012Q4	1991M1-2012M12	1994M1-2012M12	1998Q4-2012Q3	1997Q1-2012Q4	1997Q1-2012Q4	1995Q1-2012Q3
Slovenia	1999Q1-2012Q3	2000Q1-2012Q4	1989M12-2012M12	1998M1-2012M12	2000Q1-2012Q4	1996Q1-2012Q4	1996Q1-2012Q4	1995Q1-2012Q3
Spain	1999Q4-2012Q3	2000Q1-2012Q4	1989M12-2012M12	1994M1-2012M12	1998Q4-2012Q4	1995Q1-2012Q4	2000Q1-2012Q4	1995Q1-2012Q3

Table 2.2: Augmented Dickey-Fuller Test

		ADF in 1st Diff.			ADF in 1st Diff.
AUT	Real GDP	-9.622***	ITA	Real GDP	-11.902***
	GDP-Deflator	-2.658*		GDP-Deflator	-12.965***
BEL	Real GDP	-6.923***	LUX	Real GDP	-9.080***
	GDP-Deflator	-8.285***		GDP-Deflator	-9.449***
EST	Real GDP	-6.422***	NET	Real GDP	-11.748***
	GDP-Deflator	-3.964***		GDP-Deflator	-4.921***
FIN	Real GDP	-8.830***	POR	Real GDP	-10.318***
	GDP-Deflator	-8.924***		GDP-Deflator	-5.518***
FRA	Real GDP	-11.007***	SVK	Real GDP	-9.385***
	GDP-Deflator	-5.502***		GDP-Deflator	-9.839***
GER	Real GDP	-9.033***	SLV	Real GDP	-2.995**
	GDP-Deflator	-7.349***		GDP-Deflator	-3.631**
GRE	Real GDP	-2.309**	ESP	Real GDP	-8.038***
	GDP-Deflator	-5.530***		GDP-Deflator	-4.494***
IRE	Real GDP	-9.933***	Euro Area	Real GDP	-8.989***
	GDP-Deflator	-1.929*		GDP-Deflator	-3.625***

Notes: * (**) [***] denotes significance at the 10% (5%) [1%] level.

Since data are mainly available quarterly, I transformed monthly data (Consumer Price Index, Producer Price Index, International Trade) into quarterly data by calculating their arithmetic averages.

2.5 Business Cycle Analysis of Euro Area Member States

2.5.1 Estimating Demand and Supply Shocks using a Structural VAR Model

Even though empirical literature often claims to stick to the foundation of the theory of optimum currency areas, they do not decompose business cycles into demand and supply shocks as introduced by Bayoumi and Eichengreen (1994). To inquire which variables cause business cycle synchronization in an OCA sense and whether there is an indirect connection between OCA and the fiscal framework in the euro area, this decomposition is necessary for two simple reasons: first, the decomposition is a major difference between general business cycles analysis and the theory of optimum currency areas; second, both types of shocks have different indications for monetary policy. The moving average representation of the SVAR-Model is

$$\begin{bmatrix} \Delta Y_t \\ \Delta P_t \end{bmatrix} = \sum_{i=0}^{\infty} L^i \begin{bmatrix} a_{11i} & a_{12i} \\ a_{21i} & a_{22i} \end{bmatrix} \begin{bmatrix} \epsilon_{dt} \\ \epsilon_{st} \end{bmatrix} \tag{2.1}$$

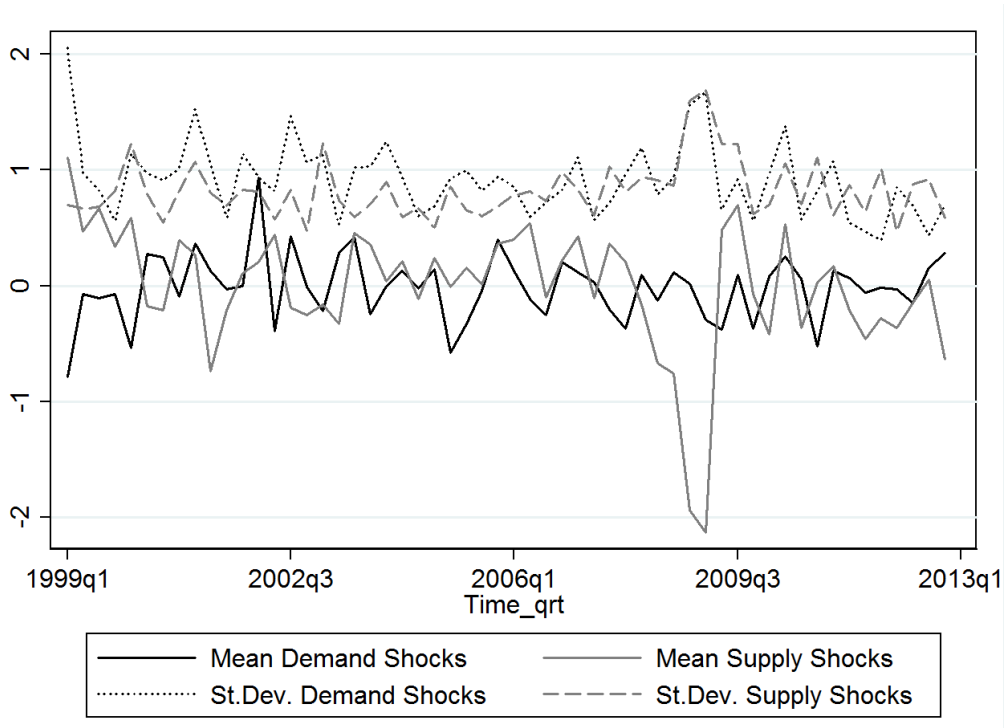
where the vector x_t contains ΔY_t and ΔP_t, representing the logarithmic change of output and prices. Independent demand and supply shocks are represented by $(\epsilon_{dt}\epsilon_{st})'$. These shocks have to be orthogonalised by $e_t = C\epsilon_t$. For a two dimensional x_t four restrictions are needed to identify C, where the fourth restriction represents the assumption that the effect of a demand shock on output is only temporarily

$$\sum_{i=0}^{\infty} a_{11i} = 0. \tag{2.2}$$

Optimal lag length is specified for each country-specific estimation using the Akaike Information Criterion. Quarterly data are used to calculate the change in natural logs of real GDP (ΔY_t) as a proxy for output and the change in natural logs of the GDP-Deflator (ΔP_t) as a proxy for the price level.

Calculating an unweighted arithmetic average of demand and supply shocks of euro area member states shows that the financial crisis hit the member states asymmetrically, as illustrated by the increase in the standard deviation of shocks (see Figure 2.1). Here and in the following analysis, new member states were added to the analysis up to two years prior to their euro area entry, because at this point in time, due to the European Exchange Rate Mechanism II (ERM II), common rules are already binding. Baskaran (2009), for example, argues that those common rules are even more binding prior to entering the euro area. Figure 2.1 shows that supply shocks were more pronounced during the peak of the financial crisis than demand shocks, but that the asymmetry among member states, as measured by the standard deviation of shocks, increased similarly on the demand and the supply side. Visual inspection reveals a spike in the standard deviation of shocks among euro area member states in 2009.

Figure 2.1: Unweighted Mean and Standard Deviation of Demand and Supply Shocks in the Euro Area



Albeit the financial crisis revealing some asymmetry among member states, the motivation is to examine the determinants of demand shocks in a broader sense and across a longer time horizon. In addition, the analysis shall be broken down from an aggregate perspective to country pairs. Given the strong emphasis on demand shocks throughout the whole OCA literature, the following analysis will focus on demand shocks.

2.5.2 Measurement of Demand Shock Synchronization

After its operationalization, OCA theory was often applied by checking the correlation between the residuals of the SVAR model to assess whether countries are sufficiently synchronized for a monetary union. Taking into account the role of business cycle volatility, in particular in periods of crisis, the use of correlation coefficients to check for synchronization seems to be flawed, given that the true relationship does not change (Corsetti et al., 2005; Forbes and Rigobon, 2002). In addition, correlation coefficients do not take potential differences in the size of shocks into account. Hence, other measures of dispersion seem to be superior in the context of business cycle synchronization analysis. To measure synchronization, this analysis uses a methodology proposed by Crespo Cuaresma et al. (2011):

$$synchro_{it}|\Omega = \frac{\hat{S}_t|\Omega_{-i} - \hat{S}_t|\Omega}{\hat{S}_t|\Omega} \tag{2.3}$$

where $\hat{S}_t|\Omega_{-i}$ is the cross-country standard deviation of demand shocks to the group Ω excluding country i and $\hat{S}_t|\Omega$ is the cross-country standard deviation of demand shocks to the group Ω including country i. Hence, the indicator, $synchro_{it}|\Omega$, takes negative (positive) values when the standard deviation of the group increases (decreases) if country i is included. This measure indicates whether one country's business cycle volatility is similar to the rest of the countries. Table 2.3 illustrates results according to the methodology of Equation (2.3) for 15 euro area member states from 1999 to 2012. An equal amount of positive and negative signs attached to countries

is not necessarily required, since "new member states" are added successively (two years before finally joining the euro area) to the anlysis, which changes the composition of $\hat{S}_t|\Omega$ over time. Mean and standard deviation of $synchro_{it}|\Omega$ is reported in Table 2.3.

Table 2.3: Demand Shock Synchronization à la Crespo Cuaresma et al. (2011)

Country	Mean	Stand. Dev.
Austria	-0.01001	0.07009
Belgium	0.00141	0.06256
Estonia	-0.01750	0.06155
Finland	0.00230	0.04906
France	0.00714	0.07069
Germany	-0.00074	0.07658
Greece	-0.00089	0.05171
Ireland	-0.00088	0.06596
Italy	-0.00526	0.07495
Luxembourg	-0.00038	0.05858
Netherlands	-0.00378	0.07074
Portugal	-0.00419	0.07351
Slovak Republic	-0.00628	0.05478
Slovenia	0.00522	0.05600
Spain	-0.01284	0.08123

Notes:
(1) * (**) [***] denotes significance at the 10% (5%) [1%] level.
(2) The analysis spans from 1999Q1 - 2012Q4 and new member countries
are added to years prior to their euro area entry.

Table 2.3 reveals that the inclusion of Belgium, Finland, France, and Slovenia results in a higher measure of group synchronization over the whole sample period. The inclusion of Austria, Estonia, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, the Slovak Republic, and Spain results in a lower measure of group synchronization over the whole sample period. Interestingly, it is not the case that peripheral countries generally lower group synchronization, whereas for example "DM-zone" countries generally contribute to a higher group synchronization.[2]

2.6 Determinants of Bilateral Demand Shock Deviation

2.6.1 Dependent Variable

Using the estimated demand shocks for each country, a time series is calculated to inquire into the causes of different demand shocks among euro area member states. Rolling correlations take the time-varying characteristic of business cycle correlation, raised by Babetski et al. (2003) in the context of OCA, into account to some degree. As already emphasized, correlation coefficients may be inappropriate due to business cycle volatility and the size of shocks. In addition, rolling correlation coefficients cause technical problems when using them as a dependent variable and make it necessary to set a window span. In light of these considerations, Cerqueira and Martins (2009) propose a synchronization index without any aggregation over time. Hence, I decided to use the modulus of the demand shocks of two countries in each period as a measure of dispersion, which does not aggregate data over time and, thus, does not lose the time variability:

$$DS_{ijt} = |DS_{it} - DS_{jt}| \tag{2.4}$$

where DS_{ijt} is the difference of the amount between a demand shock in country i at time t (DS_{it}) and country j at time t (DS_{jt}). For the following analysis this measure

[2]Members of the DM-zone (Germany, France, the Benelux countries and Austria) were supposed to be a set of suitable economies for a monetary union before the euro was introduced (De Grauwe, 1989).

will serve as the dependent variable. Given that demand shocks were estimated for 15 countries, 105 bilateral relationships are calculated in total.

2.6.2 Control Variables

As already emphasized, the endogeneity of an optimum currency area is based on increasing trade intensity. Thus, bilateral trade intensity is supposed to reduce bilateral demand shock deviation. According to Frankel and Rose (1998), I focus on export, import and total trade flows between countries. Since exports from i to j do not necessarily equal imports of j from i, I calculate three averages between countries related to either exports, imports or total trade. $bT\theta_{ijt}$ represents bilateral trade between country i and j in year t, where θ can take values from 1 to 3: 1 if the measure is calculated based on exports, 2 in case of imports and 3 if the underlying trade measure is total trade, which is the trade variable of main interest here.

Another variable of interest is the price development in the sector of non-tradable goods, NT. The price development in this sector for each country is proxied by the consumer price index, CPI_{it}, divided by the producer price index, PPI_{it} (Crespo Cuaresma et al., 2005; Égert et al., 2002). It is hypothesized that the more similar prices in the sector of non-tradables develop between two countries, the less demand shocks deviate from each other. To account for differences in external shocks, the current account balance relative to GDP, CA, is employed. It is assumed to enter the regression with a positive sign. Like demand shocks, these variables are transformed to the modulus of their difference:

$$\lambda_{ijt} = |\lambda_{it} - \lambda_{jt}| \tag{2.5}$$

where λ = NT or CA. Table 2.4 shows pairwise correlation coefficients of all variables. All three measures of bilateral trade intensity are highly correlated with each other. Prices of non-tradables and the current account balance relative to GDP are negatively correlated with trade measures and positively correlated with each other.

None of the variables is significantly correlated with the employed measure of demand shock synchronization.

Table 2.4: Descriptive Statistics

	DS_{ijt}	$bT1_{ijt}$	$bT2_{ijt}$	$bT3_{ijt}$	CA_{ijt}	NT_{ijt}
DS_{ijt}	1.000					
$bT1_{ijt}$	-0.0036	1.000				
$bT2_{ijt}$	-0.0030	0.9768*	1.000			
$bT3_{ijt}$	-0.0034	0.9939*	0.9943*	1.000		
CA_{ijt}	-0.0173	-0.2882*	-0.2853*	-0.2884*	1.000	
NT_{ijt}	-0.0101	-0.1776*	-0.1702*	-0.1745*	0.0408*	1.000

* denotes significance at the 5%-level.

2.6.3 Fiscal Divergence

The issue now becomes in which way fiscal policy should be used to investigate whether common fiscal discipline is linked to OCA or not. One could employ fiscal policy in the manner of Darvas et al. (2005) and assume that irresponsible fiscal policy causes idiosyncratic fiscal shocks. But alternatively, one can understand business cycle fluctuations as a regular feature of the economic system (Long and Plosser, 1983; Lucas, 1977). I will assume that governments accumulate debt as they act counter-cyclically in troughs but that they do not reduce this debt later in boom periods. This assumption is straightforward for the euro area, given the finding that fiscal policies became less countercyclical after the creation of the euro (Lane, 2012). It is noteworthy that the period from 2003-2007 created an opportunity for many euro area countries to reduce debt since tax revenues were historically high (Lane, 2012).

Assuming this type of government behavior implies that, once a government has reached a critical threshold, fiscal capacity to counteract a recession diminishes and the next business cycle trough gets deeper. Hence, once this threshold is reached, the impact of fiscal policy on demand shocks stems from a government which intends to smooth those regular fluctuations by fiscal measures, but ran out of capacity at some point in time. Such a threshold or the limits of fiscal capacity, respectively, can

be determined by political rules (debt ceiling, treaty, etc.), the market, or something else.

Taking this perspective makes it viable to introduce the role of fiscal policy in the form of a binary variable based on such a threshold. The most obvious choice for identifying such a threshold for the purposes of the present analysis is the use of the thresholds defined by the Maastricht treaty and the Stability and Growth Pact. This means that countries need to comply with a debt/GDP ratio below 60% as well as deficit/GDP ratio below 3%. In line with the treaty, if a country violates these thresholds, the binary variable takes on the value of 1 for this period and reflects diminished capacity to smooth regular business cycle fluctuations by fiscal measures. The definition of this binary variable for a pair of countries i and j is straightforward, best illustrated by a 2x2 matrix, as shown in Table 2.5.

Table 2.5: Fiscal Divergence Dummy (FD_{ijt})

$i \diagdown j$	in check	above specified threshold
in check	0	1
above specified threshold	1	0

The hypothesis is that if the binary variable takes the value 1, the coefficient should reflect a negative impact on the chosen synchronization measure. This effect is caused by the fact that one country is running out of capacity to counteract business cycle fluctuations, whereas the other country still has that capacity. I am fully aware that the Maastricht treaty and the Stability and Growth Pact lack a sound economic foundation. However, the research question here for the present analysis is the question of whether there is an indirect connection between the convergence criteria and the OCA theory. Such an indirect connection would be fiscal rules which assure business cycle synchronization. It is indirect since the convergence criteria lack a sound economic foundation, but intend to provide an outcome which is desirable according to OCA theory.

Assume the convergence criteria to be strictly binding in a two country world, where one country is frequently subject to idiosyncratic demand shocks. If the corresponding government permanently counteracts asymmetric demand shocks with discretionary/expansionary fiscal policy, it will reach a point at which convergence criteria *de jure* prohibit a further use of fiscal policy. At this point, such a country's business cycle ought to diverge from the other country's business cycle given the latter can still smooth fluctuations. See Agnello et al. (2013) for a different approach, which nonetheless has some similarities, as for example the impact of unilateral fiscal consolidation on business cycle synchronization.

In general, the empirical literature on this issue reveals some ambiguity. Galí and Perotti (2003) question the argument that the common fiscal discipline in the eurozone constraints the use of fiscal policy when countries need it the most and is conducive to pro-cyclical fiscal policy. Hence, they ask whether and how those constraints may have made fiscal policy in euro area member states effectively more pro-cyclical or, equivalently, less counter-cyclical. They find that constraints on fiscal policy in euro area member states have not impaired countries' ability to use fiscal policy in its stabilizing role. It is noteworthy, however, that their sample periods ends in 2001, a point in time at which most euro area countries were in either compliance with the common fiscal rules or on a path towards compliance. Galí and Perotti (2003) also mention that eurozone countries experienced only few real recessions during the observed period of time. Candelon et al. (2010) extend the contribution of Galí and Perotti (2003) to the year 2004 and find, contrary to Galí and Perotti (2003), that fiscal policy is consistently pro-cyclical over the sample. Their implication is that the common fiscal discipline in the eurozone provides member states with less room for effective discretionary fiscal policy. Recall Matthes (2009), who claims that fiscal policies, in particular the Stability and Growth Pact (SGP), could theoretically make shocks more symmetric. In sum, introducing a binary variable which reflects

the different capacities to counteract business cycle fluctuations is theoretically and empirically justifiable.

2.7 Estimation and Results

2.7.1 Baseline Regression

To assess which variables cause deviating demand shocks between two euro area member countries, a fixed effects panel model is applied.

$$DS_{ijt} = \alpha_{ij} + \beta bT\theta_{ijt} + \gamma FD_{ijt} + x'_{ijt}\beta + \mu_{ij} + \delta_t + \epsilon_{ijt}. \tag{2.6}$$

Given the use of several measures, $bT\theta_{ijt}$ reflects bilateral trade intensity where θ can take values from 1 to 3. FD_{ijt} reflects fiscal divergence as introduced in the form of a binary variable. α_{ij} represents the constant, while other covariates, such as prices of non-tradables, NT, and current account balance relative to GDP, CA, are included in the vector x'_{ijt}. In addition, μ_{ij} reflects entity fixed effects, which control for unobserved contemporaneous correlation between countries due to heterogeneous country pairs, and δ_t reflects time fixed effects, which control for unobserved effects different across country pairs but equal across periods of time. Clustered standard errors are estimated.

Results are shown in Table 2.6. The only variable which remains statistically significant at the 10%-level with the proposed sign across most specifications is bilateral trade. Even though all measures for trade-intensity are highly inter-correlated, the first measure, based solely on exports, enters the regression analysis statistically insignificantly. The second as well as the third measure of trade intensity are statistically significant at the 10%-level across all respective specifications. Hence, weak evidence is provided that the role of trade is in line with the existing literature, seems to be independent from the construction of the dependent variable, and also holds using a richer set of controls compared to other studies. Artis and Okubo (2011) and

Cerqueira and Martins (2009) also use synchronization indices different from standard correlations in a panel framework and find trade intensity to be deterministic.

Table 2.6: Fixed Effects Panel Model (1/2)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FD	0.034	0.032	0.035	0.035	0.034	0.036	0.035	0.034	0.036
	(0.034)	(0.033)	(0.034)	(0.034)	(0.033)	(0.034)	(0.034)	(0.033)	(0.034)
T1	-7.915	-6.558	-8.315						
	(7.185)	(7.064)	(7.194)						
T2				-14.945*	-15.279*	-14.984*			
				(8.943)	(9.065)	(8.976)			
T3							-15.629*	-15.126*	-15.849*
							(9.069)	(9.018)	(9.113)
CA	-0.002		-0.002	-0.002		-0.002	-0.002		-0.002
	(0.692)		(0.004)	(0.004)		(0.004)	(0.004)		(0.004)
NT	-0.435	-0.438		-0.460	-0.460		-0.435	-0.434	
	(0.453)	(0.578)		(0.576)	(0.575)		(0.577)	(0.576)	
Constant	0.448***	0.969***	0.437***	1.321***	1.062***	1.296***	0.489***	1.068***	0.476***
	(0.085)	(0.133)	(0.084)	(0.166)	(0.148)	(0.166)	(0.082)	(0.149)	(0.081)
Number of obs	4016	4030	4016	4023	4037	4023	4016	4030	4016
Number of groups	105	105	105	105	105	105	105	105	105
R-sq: within	0.169	0.168	0.169	0.170	0.169	0.170	0.169	0.169	0.169
R-sq: between	0.010	0.013	0.009	0.002	0.001	0.002	0.002	0.002	0.002
R-sq: overall	0.149	0.153	0.146	0.119	0.115	0.118	0.114	0.114	0.112

Notes:
(1) * (**) [***] denotes significance at the 10% (5%) [1%] level.
(2) Robust standard errors are reported in parentheses.

The binary variable reflecting fiscal divergence is statistically insignificant across all specifications, which reflects a common claim in the literature that the Maastricht treaty ignores the OCA criteria (Sapir, 2011). The most obvious reason as to why the employed thresholds fail to enter the regression statistically significant is the lack in bindingness of those thresholds (Spolaore, 2013; Lane, 2012). Whether strictly binding thresholds would enter the analysis with statistical significance remains an open question. What can, however, be answered based on the obtained results is that, as long as a common fiscal discipline is not strictly binding, there is no indirect connection to the principles of OCA theory.

2.7.2 New Member States

Jonas (2006) emphasizes that new member countries should overachieve the fiscal rules some time prior to their entry, in order to be equipped with some flexibility when joining the monetary union. One can easily extend this argument by assuming

that fiscal rules are more binding for newer member states. This is due to the fact that those economies are much smaller than countries like Germany or France. Prior to the creation of the euro, Wyplosz (1997) already expected Germany and France to exercise their veto power should they lack compliance with the common fiscal discipline. As we know today, this did indeed happen. In general, it is assumed that political power is determined by economic size and that more political power reduces incentives to comply with common rules (Berger et al., 2007). In order to take this argument into account, equation (2.6) is modified

$$DS_{ijt} = \alpha_{ij} + \beta bT\theta_{ijt} + \gamma FD_{ijt}xD_{new} + x'_{ijt}\beta + \mu_{ij} + \delta_t + \epsilon_{ijt} \tag{2.7}$$

where D_{new} equals 1 if one of the countries i or j joined the euro area after 1999. In more than 50% of observations across all country pairs, new member states violated the common fiscal discipline. Results are shown in Table 2.7.

Table 2.7: Fixed Effects Panel Model (2/2)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FD	0.118*	0.117**	0.121**	0.117*	0.116*	0.120**	0.117*	0.116**	0.120**
	(0.060)	(0.059)	(0.060)	(0.059)	(0.059)	(0.060)	(0.060)	(0.059)	(0.060)
T1	-9.577	-7.758	-9.906						
	(6.916)	(6.625)	(7.031)						
T2				-9.583	-9.894	-9.568			
				(7.969)	(8.049)	(8.082)			
T3							-12.457	-11.755	-12.625
							(8.496)	(8.294)	(8.699)
CA	-0.003		-0.003	-0.004		-0.003	-0.004		-0.003
	(0.004)		(0.004)	(0.004)		(0.004)	(0.004)		(0.004)
NT	-0.297	-0.262		-0.328	-0.295		-0.310	-0.273	
	(0.521)	(0.513)		(0.522)	(0.513)		(0.521)	(0.513)	
Constant	2.427***	2.380***	2.491***	2.420***	2.402***	2.477***	2.462***	2.431***	2.523***
	(0.344)	(0.338)	(0.299)	(0.333)	(0.329)	(0.289)	(0.345)	(0.339)	(0.301)
Number of obs	4178	4205	4214	4185	4212	4221	4178	4205	4214
Number of groups	105	105	105	105	105	105	105	105	105
R-sq: within	0.177	0.176	0.180	0.178	0.177	0.181	0.177	0.176	0.181
R-sq: between	0.004	0.006	0.005	0.004	0.004	0.004	0.003	0.003	0.003
R-sq: overall	0.149	0.155	0.151	0.152	0.148	0.155	0.137	0.138	0.139

Notes:
(1) * (**) [***] denotes significance at the 10% (5%) [1%] level.
(2) Robust standard errors are reported in parentheses.

The impact of trade vanishes, whereas the coefficient of fiscal divergence takes on the hypothesized sign and becomes statistically significant across specifications at the 10% or 5% level, respectively. How can these results be interpreted? As emphasized, new member states have less political power, which makes the common fiscal discipline more binding for them. Consequently, the manner in which a measure of fiscal divergence was introduced in the present study is more appropriate for those countries. If new member states breach the political threshold, their fiscal ability to smooth fluctuations will be more constrained. Hence, although in general the results do not sketch a clear explanation of what determines demand shock synchronization for the complete set of euro area member states, results are supportive to the argument outlined by Jonas (2006), who argues that new member countries shall overachieve the fiscal rules prior to their euro area entry. Less political power at the European level might cause this finding.

2.8 Conclusion

This paper aims at identifying potential sources of demand shock synchronization across euro area member states. The distinction between demand and supply shocks is relevant for the empirical analysis to be in line with theory of optimum currency areas and also due to the different implications for monetary policy making that arise from either demand or supply shocks. To elaborate on the determinants of bilateral demand shock synchronization, which historically has received much more research attention compared to supply shocks, demand shocks are estimated with a structural vector autoregression. Applying a synchronization measure does not reveal any pattern which would indicate the existence of a "periphery" of countries systematically different from the other euro area member countries.

Variables of interest assumed to induce differences in demand shocks between countries are identified and employed in a fixed effects panel model. The regression analysis provides weak evidence that higher bilateral trade intensity is associated

with demand shock synchronization among euro area member states. The analysis fails to attach any significant role to fiscal thresholds as defined by the Maastricht treaty and the Stability and Growth Pact. Given the existing literature (Crespo Cuaresma et al., 2011; Mikek, 2008; Artis et al., 2008; Darvas et al., 2005), when it comes to business cycle synchronization it seems to be more about a sustainable fiscal position or path and less about thresholds.

However, taking into account that fiscal rules might be more binding for new member states, which are assumed to be equipped with less political power changes the initially obtained results. For new member states, fiscal divergence is associated with bilateral demand shock divergence. Hence, the results support Jonas (2006) arguing that new member countries should overachieve the fiscal rules some time prior to their final entry into the euro area to be equipped with some flexibility when being an euro area member. From the perspective of European integration, further enhancement of intra-eurozone trade would be supportive to the single currency area and new member states are recommended to enter the euro area with sufficient fiscal capacity.

Chapter 3

Exchange Rate Policy in China after the Financial Crisis: Evidence from Time-Varying Exchange Rate Basket

3.1 Abstract and Details of the Article

3.1.1 Abstract

We analyze the period of a managed floating exchange rate policy in China between June 2010 and November 2014. We estimate a time varying structure of a hypothetical currency basket using the Kalman filter. We show that the exchange rate policy continues to focus on the US dollar. However, its weight has been gradually declining, while this decline has moderated in 2014. The euro played some role before summer 2011, but became negligible after the outbreak of the European sovereign debt crisis. Finally, the Thai baht has positive implicit weights.

JEL Classifications: E58, F33, C32.

3.1.2 Details of the Article

This article is joined work with Jarko Fidrmuc.[1] I presented it at the following conferences:

- INFER Annual Conference, Orléans/ France, May 2013.
- Asian Meeting of the Econometric Society, Singapore, August 2013.
- Exchange Rates, Monetary Policy and Financial Stability in Emerging Markets and Developing Countries, Leipzig/ Germany, October 2014.

The Verein fuer Socialpolitik in cooperation with the Deutsche Bundesbank promote an international presence of young scientists with a subsidy of 500 euro for presentations at prestigious international conferences. Since the Asian Meeting of the Econometric Society is among these prestigious international conferences, I was honored with this award in 2013. In 2014, my participation at the conference in Leipzig was sponsored by the Stiftung Geld und Waehrung.

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3.2 Introduction

The World Bank expects China to become a high-income economy as well as the world's largest economy before 2030 (World Bank, 2013). After the Chinese administration introduced unprecedented reforms in 1980s, today nearly a quarter of the population lives in cities with an income per capita which resembles that of certain OECD countries. In particular, gross domestic product (GDP) per capita in purchasing power parity (PPP) in Chinas richest 25 metropolitan areas is on average

[1] We would like to thank Iikka Korhonen, Linlin Niu, and the participants of several conferences for helpful comments and discussions.

equivalent to Portugals value (OECD, 2013). Not surprisingly, growth in the world's most populous country has changed the distribution of economic activities across the world. According to International Monetary Fund (IMF) data, the share of Chinese GDP in the world economy, valued at purchasing-power-adjusted prices, nearly doubled from 7.5% in 2001 to 14.3% in 2011. This remarkable economic development is accompanied by financial sector reforms and growing competition among domestic companies.

In contrast to the majority of central banks in advanced economies, the People's Bank of China (PBC) does not only use standard instruments of monetary policy. The use of multiple instruments is aimed at supporting the PBC's monetary policy, which pursues multiple objectives − price stability, economic growth and exchange rate stability (Sun, 2013). The objective of exchange rate stability led observers of the Chinese exchange rate regime witnessing several back-and-forth changes, accompanied by minor adjustments, between 1996 and 2014. Those changes mainly consisted of two different regimes – namely, a currency peg against the US dollar and a peg against a basket of currencies with secret weights. Due to its opaque composition, the latter is of main interest. The actual composition of the basket of currencies is relevant for economists in order to gain a better understanding of the Chinese exchange rate management, but for policy makers and business as well. In addition, for economists, the actual composition of the basket of currencies relates to many discussions beyond exchange rate regimes, such as global imbalances and international trade competitiveness, to name the most important ones.

Compared to the first period of a managed floating exchange rate regime, the second period has received surprisingly little academic attention so far. However, analyzing this second period of a managed floating exchange rate regime allows to identify changes in the Chinese exchange rate management in the aftermath of the financial crisis, by comparing findings to those obtained from the first period of a managed floating exchange rate regime. Another observation motivating an

assessment of the current regime is the gradual widening of the floating bands of the renminbi against the US dollar, which implies a more market oriented exchange rate and is mirrored in the halt of accumulation of foreign exchange reserves[2] by the PBC in 2012 (OECD, 2013). The first period of managed floating regime was characterized by a remaining *de facto* peg against the US dollar, allowing for less appreciation than expected. It is important to note that expectations regarding the current regime seem to have adjusted. Most recently, the difference between the spot rate of the renminbi against the US dollar and the corresponding 12 months non-deliverable forwards is rather negligible, whereas it achieved considerable values during the first period of managed floating from 2005 to 2008 (see Figure 3.1a).

To our best knowledge, there are only very few treatments of the second floating exchange rate regime period so far. We aim to fill this gap in the literature. We apply the methodology proposed by Fidrmuc et al. (2010) and estimate the weights of selected international currencies for the renminbi exchange rate management. We show that the second and most recent period of exchange rate reforms shows some similarities to the first, but also many differences. First, we confirm the dominance of the US dollar also during this second period of managed floating. Second, we observe a declining weight attached to the US dollar between 2010 and 2014, while the decline of the US dollar weight moderated after a short-lived increase in 2014. Furthermore, deviations from the gradual decline of the weight attached to the US dollar coincide with major political and economic events in the Unites States. Third, we observe slight evidence that the euro was used as an exchange rate target at the beginning of the second period of managed floating, but its weight approached zero after the deepening of the debt crisis in the European Monetary Union. Finally, the Thai baht gained importance compared to the first period of managed floating (Fidrmuc et al., 2010).

[2]This is consitstent with the observation by Calvo and Reinhart (2002) that the variance of reserves should be zero in a pure float.

Hence, this study contributes to the discussion regarding China's managed floating exchange rate regime and sheds some light on the most recent composition of the secret basket of currencies used by the PBC. It contributes to our understanding of how far China's exchange rate policy has changed in the aftermath of the latest policy announcements and the financial crisis.

The remainder of the paper is structured as follows. The next section discusses the development of the Chinese exchange rate policy and the corresponding deviations from *de facto* and *de jure* policies, and reviews the relevant literature. Section 3 describes the data and identifies relevant sub-periods for our estimations, while Section 4 describes the empirical method for the estimation of time-varying exchange rate baskets. Section 5 reports and describes the results using time-varying coefficients based on the Kalman filter. Section 6 provides robustness analyses. The last section concludes the paper.

3.3 Chinese Exchange Rate Policy

3.3.1 De Jure Exchange Rate Policy

Since the introduction of current account convertibility in 1996, the stable exchange rate has been used to anchor inflation expectations (see e.g. McKinnon and Schnabel, 2012; Nair and Sinnakkannu, 2010). After more than a decade of pegging the renminbi (RMB) to the US dollar (USD) at an exchange rate of RMB 8.28 per 1 USD, the PBC announced a revaluation of its currency and a reform of the exchange rate regime on the 21st of July, 2005. The main part of the exchange rate reform was, according to the announcement of the PBC, the introduction of a peg to a basket of currencies with secret weights and with narrow fluctuation bands of $\pm$ 0.3% on daily changes against the USD and $\pm$ 1.5% on daily changes against the Japanese yen (JPY) and the euro (EUR). There were more currencies but USD, EUR and JPY

should be the most important.[3] However, in August 2008, the PBC again pegged the RMB to the USD after the outbreak of the financial crisis.

The PBC announced a return to the managed floating exchange rate policy on the 19th of June, 2010. In addition, the PBC widened the floating bands of the RMB against the USD in the inter-bank spot foreign exchange market from 0.5% to 1% in April 2012 and to 2% in March 2014. This has signaled a move towards a more market-determined exchange rate regime. Moreover, the exchange rate has depreciated in the first half of 2014.

3.3.2 Literature Review - De Facto Exchange Rate Policy

Due to the rising importance of the Chinese economy and its deep trade integration with other economies, Chinese policy measures are of increasing consequence outside of China. Exchange rate regimes and the possible equilibrium level of exchange rates belong to one of the most controversial issues in the world economy today.

This first period of a managed floating exchange rate regime from 2005 to 2008 is analyzed in several papers (Frankel, 2006; Funke and Gronwald, 2008; Fidrmuc et al., 2010; Tian and Chen, 2013). The empirical evidence confirmed the international markets' skeptical view, as they believed that the old policy would be continued under the new regime. This first period of managed floating was characterized by a remaining *de facto* peg against the US dollar allowing for some appreciation of the renminbi against the US dollar. The history of exchange rate regimes witnessed many deviations between *de facto* and *de jure* exchange rate regimes across countries (Reinhart and Rogoff, 2002, 2004). To pursue a more rigid exchange rate policy than officially announced corresponds to the so-called fear-of-floating phenomenon

[3]During the first period of flexible exchange rates in China, *de jure* exchange rate policy was designed as a peg to a secret basket of selected international currencies which are supposed to remain more or less the same also during the current period (PBC, 2010). According to the PBC, the secret basket for the Chinese exchange rate policy may include the US dollar (USD), the Japanese yen (JPY), and the euro (EUR). Other currencies, namely those of Australia (AUD), Canada (CAD), Great Britain (GBP), Malaysia (MYR), Russia (RUB), Singapore (SQD), South Korea (KRW), and Thailand (THB), were also announced to play some role, however this has not been confirmed by previous research (Fidrmuc et al., 2010).

(Calvo and Reinhart, 2002). Moreover, the empirical literature is accompanied by several theoretical arguments in favor of a managed floating regime. In addition to the implication for the trade between China and the USA, the discussion points out that the *de facto* peg of the RMB against the USD results in a stabilization of the RMB against a much broader set of currencies. This has important implications for inter-regional trade in Asia and for the dollar-based financial and commodity markets beyond Asia. Following McKinnon and Schnabl (2012) this broader effect of a "dollar-peg" is based on the facts that trade in East Asia is invoiced in USD and that the USD remains the dominant means of settling international payments.

IMF (2013) classifies China's exchange rate arrangement as a crawl-like arrangement where a monetary aggregate is targeted, which basically serves as an exchange rate anchor to the USD. However, compared to the first period of a managed floating exchange rate regime from July 2005 to August 2008, the second period which started in June 2010 has received much less academic attention so far. Wang and Xie (2013) find that the secret currency basket is again arranged with the USD as the most important currency followed in decreasing order by the EUR, the JPY, and the Korean won (KRW).

3.3.3 Literature Review - Policy Implications

Chinese exchange rate management is often blamed to be a source of global current account imbalances by not allowing the renminbi to float freely. In addition, the Chinese administration is often criticized as keeping its exports artificially cheap by not allowing the renminbi to appreciate. In particular, during the last presidential elections in the USA, these issues were heatedly debated (Lo, 2012), and they also received some attention at international gatherings of high-level politicians.

Given China's position in the global supply chain, Thorbecke and Smith (2010) argue that a RMB appreciation alone cannot solve the global imbalances. The question of whether an appreciation of the RMB against the USD can also rectify trade

imbalances between the two countries is theoretically addressed by McKinnon and Schnabl (2009), McKinnon and Schnabl (2012), and Qiao (2007), as well as empirically by Zhang and Sato (2012). McKinnon and Schnabl (2009, 2012) argue that an appreciating RMB would turn China into a higher cost country, thereby forcing globally oriented firms to invest elsewhere. As a result, China's saving-investment balance and trade surplus could increase rather than decrease. Empirically, the dynamic effect of the bilateral exchange rate of China and the US on China's trade balance is very limited (Zhang and Sato, 2012). Despite the RMB's appreciation in nominal terms against the USD between 2005 and 2008, the bilateral trade balance between the two countries increased.

Nair and Sinnakkannu (2010) find that between July 2005 and June 2009, a period of an appreciating RMB against the USD, has not altered China's international trade competitiveness. In contrast, Thorbecke and Smith (2010) find that a 10% unilateral appreciation of the RMB against the currencies of those countries buying Chinese final exports would diminish manufacturing exports by almost 12%. With respect to growth, Rodrik (2008, 2010) reports estimates which imply that a 10% real appreciation would reduce growth in China by 0.86 percentage points.

3.4 Data Description

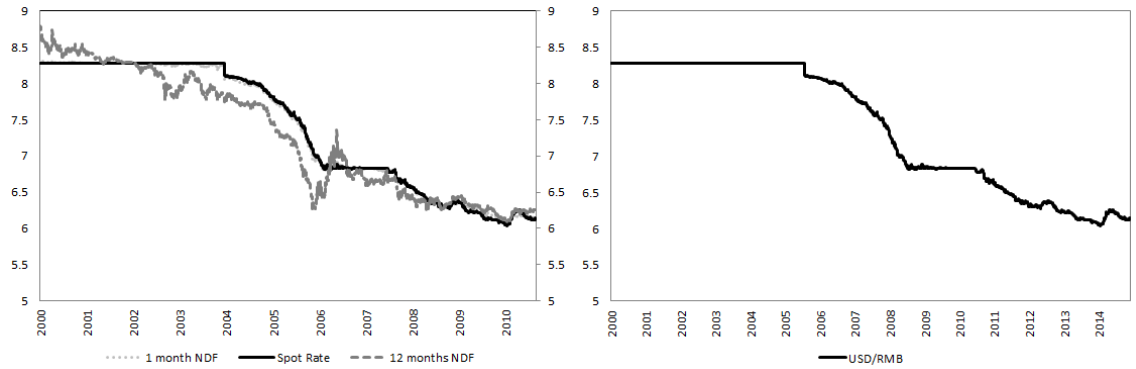
We have daily exchange rate data of the RMB and selected major currencies, namely USD, JPY, and EUR between June 2010 and November 2014 (for descriptive statics we use longer time periods). Furthermore, we include the KRW and the Thai baht (THB) as two additional Asian currencies.[4] According to the PBC's communication, earlier literature, and our preliminary analysis on the additional Asian currencies, our focus on the role the selected major currencies is justified. However, the inclusion of Asian currencies is necessary in order check whether those currencies have become more important over time. Motivated by the existing gap in the

[4]According to IMF (2013), Thailand and South Korea run a floating exchange regime in an inflation-targeting framework.

literature, the empirical part concentrates on the second period of managed floating, characterized by a relatively variable RMB exchange rate between June 2010 and November 2014. The data are according to Bloomberg. Exchange rate data relate to trading days of the New York Stock Exchange but result from 24/7 over-the-counter quotes from market contributors. Hence, given the simultaneity of our data, different time zones related to different geographical locations of stock exchanges have not been taken into consideration.

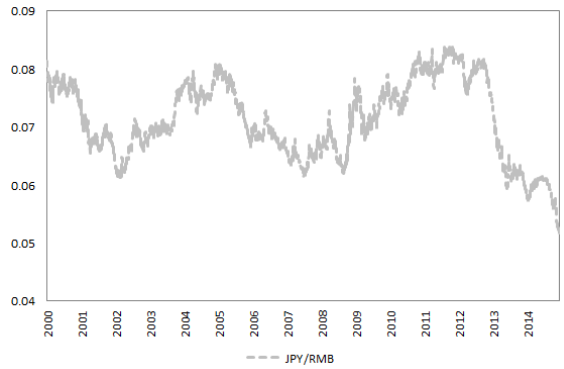
We select the Australian dollar (AUD) and the Swedish krona (SEK) as reference currencies, following the argument of Calvo and Reinhart (2002), as they are both considered to be a typical free floating currency of a relatively small country. We are aware that the Australian dollar is included in the list of the target currencies published by the PBC. Given that the previous analyses did not find any significant *de facto* weight for this currency, we believe that the possible bias is negligible. We do not take the Swiss franc (CHF) into account, which was recommended by Funke and Gronwald (2008), because the Swiss Central Bank has tried to avoid excessive appreciation of the CHF against the EUR and has even set appreciation limits recently, which could bias the results for the euro.

Figure 3.1: Stylized Facts on the RMB



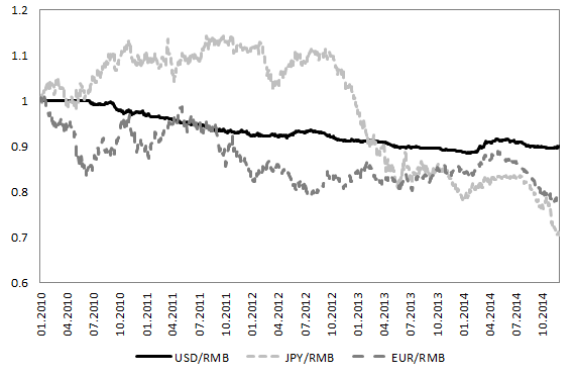
(a) NDF

(b) RMB/USD

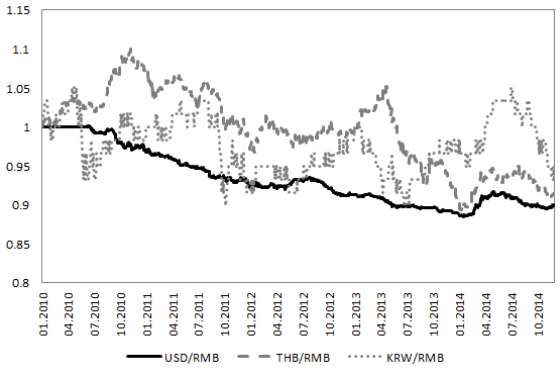


(c) JPY/RMB

(d) EUR/RMB



(e) RMB against Major Currencies



(f) RMB against Asian Currencies

Notes: (a) Prices of Non-Deliverable Forwards (NDFs) and Spot Price (01/2000 – 11/2014). (b) - (d) Exchange Rate of the renminbi against the US dollar, the Japanese yen, and the euro (01/2000 – 11/2014). (e) - (f) Value of the RMB in terms of other major currencies: second period of managed floating; per RMB (indexed: January 2010 = 1). Source: Bloomberg.

We start our analysis with the presentation of descriptive statistics for different sub-periods of Chinese exchange rate policy. Figure 3.1b illustrates that changes in the Chinese exchange rate policy can be easily identified by visual inspection of the exchange rate of the RMB against the USD. The exchange rates of the RMB against the JYP and EUR, respectively, do not appear to be politically managed (see Figure 3.1c and Figure 3.1d). Finally, comparing all three exchange rates indexed at the beginning of 2010, the exchange rate of the RMB against the USD gradually appreciates, whereas the JPY and the EUR reveal much more variability and, thus, appear to be less managed than the USD (see Figure 3.1e). Similarly, the THB and the KRW, respectively, reveal an almost equivalent picture in terms of less political intervention compared to the USD (see Figure 3.1f). Table 3.1 shows that the mean change in the exchange rate of the RMB against the USD from July 2005 to June 2008 and from June 2010 to November 2014 is statistically significantly different from zero. Mean changes of the RMB against the JPY, the EUR, the KRW, and the THB over time as well as during the sub-periods are not significantly different from zero. This provides the first evidence that the USD has been playing a more important role for the Chinese exchange rate policy than the remaining currencies.

Table 3.1: Descriptive statistics of the RMB, January 1996 to September 2014

			01/00-11/14 (Total Sample)	01/00-07/05 (USD Peg)	07/05-06/08 (Managed Floating)	07/08-06/10 (USD Peg)	06/10-011/14 (Managed Floating[a])
USD/RMB	**First Diff**	Mean	-0.055	0.000	-0.181	-0.009	-0.041
		Std. Dev.	0.584	0.024	0.902	0.507	0.636
		t-statistic	-5.864	-0.355	-5.649	-0.412	-2.641
		p-value	0.000	0.723	0.000	0.681	0.008
	Levels	Mean	7.393	8.277	7.685	6.833	6.478
		Std. Dev.	0.854	0.001	0.386	0.010	0.286
		Min	6.041	8.276	6.811	6.797	6.041
		Max	8.280	8.280	8.113	6.887	6.887
JPY/RMB	**First Diff**	Mean	-0.001	-0.001	-0.001	0.002	-0.001
		Std. Dev.	0.049	0.051	0.042	0.067	0.050
		t-statistic	-0.962	-0.405	-0.834	0.750	-0.603
		p-value	0.336	0.686	0.405	0.454	0.546
	Levels	Mean	0.071	0.072	0.067	0.072	0.072
		Std. Dev.	0.007	0.005	0.003	0.004	0.008
		Min	0.052	0.061	0.062	0.062	0.052
		Max	0.084	0.081	0.074	0.079	0.084
EUR/RMB	**First Diff**	Mean	-0.022	0.108	0.076	-0.464	-0.195
		Std. Dev.	5.704	5.914	5.000	7.842	5.833
		t-statistic	-0.236	0.696	0.428	-1.312	-1.361
		p-value	0.814	0.486	0.669	0.190	0.174
	Levels	Mean	9.035	8.717	10.263	9.397	8.737
		Std. Dev.	1.105	1.291	0.416	0.537	0.665
		Min	6.848	6.848	9.433	8.146	7.588
		Max	11.286	11.286	11.177	10.672	10.769
KRW/RMB	**First Diff**	Mean	0.000	0.000	0.000	0.000	0.000
		Std. Dev.	0.005	0.005	0.005	0.009	0.006
		t-statistic	-0.528	0.315	-0.875	-0.456	-0.483
		p-value	0.598	0.753	0.382	0.649	0.629
	Levels	Mean	0.007	0.007	0.008	0.006	0.006
		Std. Dev.	0.001	0.001	0.001	0.000	0.000
		Min	0.004	0.006	0.007	0.004	0.004
		Max	0.009	0.008	0.009	0.007	0.007
THB/RMB	**First Diff**	Mean	-0.001	-0.002	0.001	0.001	-0.001
		Std. Dev.	0.099	0.074	0.176	0.051	0.058
		t-statistic	-0.593	-0.967	0.156	0.571	-0.739
		p-value	0.553	0.334	0.876	0.568	0.460
	Levels	Mean	0.205	0.199	0.219	0.201	0.203
		Std. Dev.	0.013	0.010	0.016	0.006	0.009
		Min	0.181	0.181	0.194	0.189	0.183
		Max	0.261	0.224	0.261	0.212	0.225

Note: The first differences of the bilateral exchange rates against the RMB are multiplied by 100. a - fluctuation band was extended in April 2012 and March 2014.

For reliable statistical inference in the following empirical analysis it is necessary to check whether the time series under consideration are stationary or not. The traditional approach for analyzing the composition of the Chinese exchange rate basket relies on OLS regressions employing data in first differences. Since levels might be more informative than first differences, and for technical reasons, we make use of the Kalman filter. All time series under consideration ought to be non-stationary in levels. Given such statistical properties, the Kalman filter represents an alternative to traditional OLS regressions. Applying both augmented Dickey-Fuller and Phillips-Perron tests (available upon request), we have robust evidence that all time series are non-stationary in levels but stationary in first differences of the natural logarithm.

3.5 Estimation of the Implicit Currency Basket

Even though the actual composition of the currency basket is unknown to the public, implicit weights can be estimated on the base of actual exchange rate developments of the RMB vis-*à*-vis a list of potential target currencies. Originally this approach was proposed by Haldane and Hall (1991) and applied to China by Frankel and Wei (2007, 2008) and then followed in the literature. Although OLS regressions and rolling regression[5] have dominated the previous literature, they are subject to possible drawbacks, which were ignored in this literature. First, the relationship has to be estimated over some time period, while the weights may be subject to frequent or even continuous changes. Therefore, the majority of studies estimate rolling regressions usually using a comparatively short window. However, this often results in a relatively low number of observations despite the use of daily data. Moreover, the structural changes are then artificially smoothed and cannot be clearly attributed to a specific date. This can result in higher and correlated errors from the regression.

[5]OLS regressions and rolling regressions are available upon request from authors.

3.5.1 Kalman Filter

Following Harvey (1989) and Ogawa and Sakane (2006), the structure of the currency basket with time varying weights is estimated by the Kalman filter. By the use of the Kalman filter we address both points of criticism. Firstly, we take into account the possibility that coefficients are changing gradually, by using an alternative methodology of estimation. Secondly, we use data in levels (without taking logs) to see whether non-differenced time series are more informative regarding the changes of *de facto* exchange rate policy. The Kalman filter is appropriate for the estimation of the relationship between integrated variables. The estimation equation for exchange rate e can be stated as

$$e_{rmb/cur,t} = \alpha + \sum_{k=1}^{K} \omega_{k,t} e_{k/cur,t} + \epsilon_t, \tag{3.1}$$

where α is the intercept, the reference currency is denoted by *cur* and is either AUD or SEK, k stands for analyzed currencies (USD, EUR, JPY, KRW, THB), and the remaining parameters are estimated as time varying parameter processes which follow a random walk

$$\omega_{i,t} = \omega_{i,t-1} + \eta_{i,t} \quad \text{where} \quad i = usd, eur, jpy, krw, thb. \tag{3.2}$$

As the analysis of the first period of flexible exchange rate showed that only the main currencies were actually used for the determination of the exchange rate, we focus on the USD, the EUR and the JPY in our analysis. However, we include additional Asian currencies.

3.6 Time-Varying Approach in Levels

As emphasized, the results obtained by OLS regressions are subject to many drawbacks and do not reflect policy changes accurately. We address this issue by estimating the implicit currency weights by the Kalman filter in levels, using the

methodology proposed by Fidrmuc et al. (2010) to estimate equation (3.1) with time varying coefficients. In order to avoid results selective to the choice of the reference currency, *cur*, we use the Australian dollar (AUD) as well as the Swedish krona (SEK) as reference currencies.

3.6.1 Australian Dollar as Reference Currency

Block A of Table 3.2 shows the final state estimates[6] of equation (3.1) using the Australian dollar as reference currency. Figure 3.2 provides the corresponding time-varying weights and confidence intervals. We start with a simple specification for the USD as the single explanatory currency of the RMB's exchange rate. The development pattern of estimated coefficients corresponds closely to the announced policy changes (see Figure 3.2, first column). The coefficient of the USD starts to fluctuate in June 2010, departing from a value of 1 implied by the peg prior to the policy change. This specification shows that, after an initial decline, the weight of the USD stabilized again starting around mid-2011, increased in summer 2012, and dropped after summer 2012, which may correspond to the presidential elections in the US that were taking place at that time. However, the trend of a declining weight attached to the USD continued in 2013. Finally, the coefficient of the USD moderated after an increase in the beginning of 2014, which corresponds to the RMB depreciation but also coincides with the tapering of the Federal Reserve System (FED) in the United States. The FED initially announced its plans to reduce the purchase of asset-backed securities in June 2013 and finally decided to do so in December 2013.

[6]However, we have to keep in mind that the estimated weights presented in the table refer to one time point only.

Table 3.2: Time-varying weights (final states estimates) & Robustness

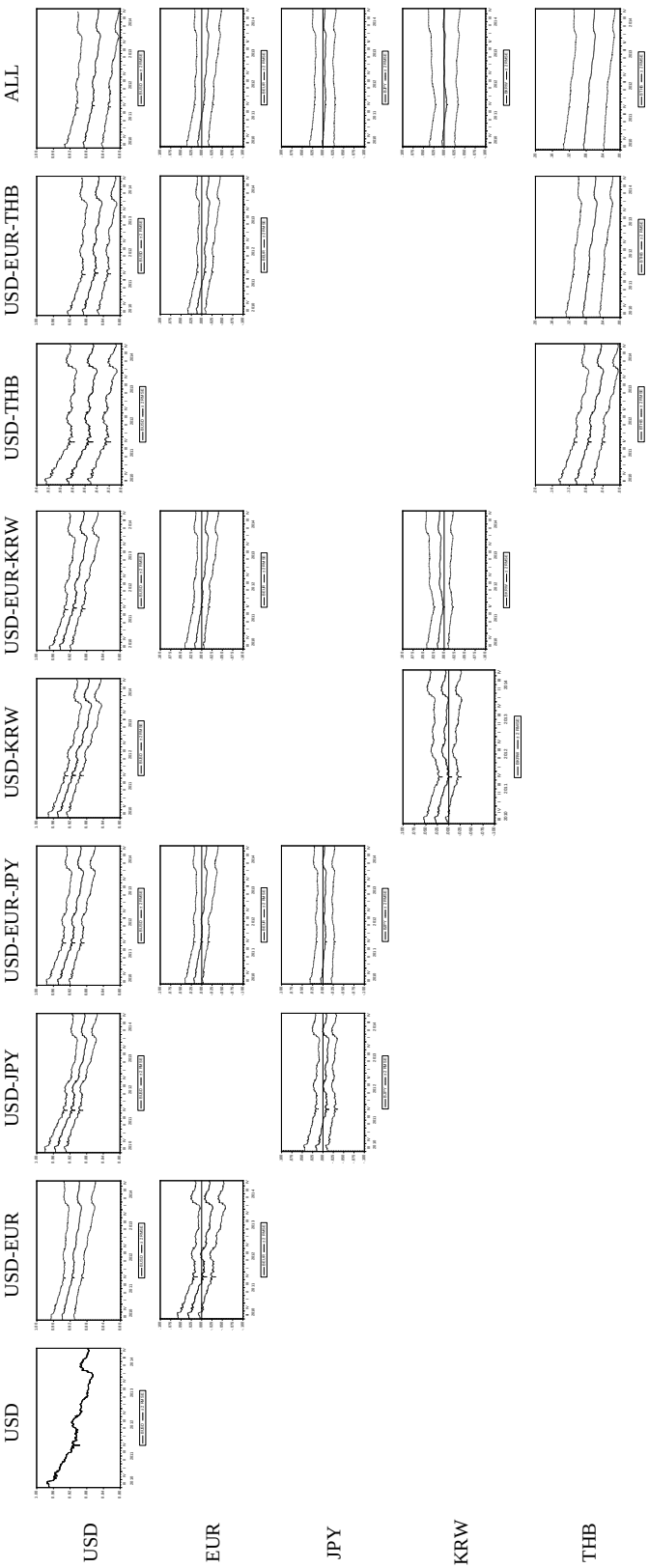
Block A: AUD as Reference Currency									
	USD	USD-EUR	USD-JPY	USD-KRW	USD-THB	USD-EUR-JPY	USD-EUR-KRW	USD-EUR-THB	ALL
USD	0.878***	0.899***	0.885***	0.876***	0.848***	0.895***	0.888***	0.852***	0.853***
	(877.978)	(47.097)	(57.702)	(60.007)	(44.236)	(51.249)	(51.913)	(41.812)	(34.475)
EUR		-0.018***				-0.011	-0.014	-0.016	-0.015
		(-1.029)				(-0.761)	(-0.992)	(-1.183)	(-0.935)
JPY			-0.007			-0.003			-0.004
			(-0.595)			(-0.257)			(-0.317)
KRW				0.008			0.011		0.000
				(0.466)			(0.699)		(-0.017)
THB					0.046**			0.058***	0.061**
					(2.267)			(2.864)	(2.502)
Const	1.926***	1.767	2.107**	1.415**	0.505	1.832	1.430	0.685	0.767
	(4.148)	(0.921)	(2.573)	(2.151)	(0.542)	(1.557)	(1.514)	(0.563)	(0.548)
LL	463.051	366.292	455.104	499.504	497.239	451.238	472.743	475.595	373.005
AIC	-0.802	-0.634	-0.788	-0.865	-0.862	-0.782	-0.819	-0.824	-0.646
SC	-0.798	-0.630	-0.784	-0.861	-0.857	-0.777	-0.815	-0.820	-0.641
No of obs.	1152	1152	1152	1152	1152	1152	1152	1152	1152
Block B: SEK as Reference Currency									
	USD	USD-EUR	USD-JPY	USD-KRW	USD-THB	USD-EUR-JPY	USD-EUR-KRW	USD-EUR-THB	ALL
USD	0.881***	0.911***	0.886***	0.875***	0.857***	0.902***	0.893***	0.867***	0.861***
	(881.126)	(47.578)	(57.785)	(82.632)	(45.459)	(51.654)	(56.426)	(43.127)	(35.486)
EUR		-0.033*				-0.027*	-0.029**	-0.032**	-0.032*
		(0.053)				(-1.878)	(-2.190)	(-2.285)	(-1.957)
JPY			-0.005			0.001			-0.001
			(-0.409)			0.105			(-0.045)
KRW				0.014			0.018		0.015
				(1.114)			(1.527)		(1.099)
THB					0.035*			0.050**	0.044
					(1.766)			(2.473)	(1.860)
Const	1.671***	2.456	1.784***	1.064	0.719	2.477**	2.197*	1.929	1.837*
	(4.577)	(1.237)	(2.728)	(1.528)	(0.992)	(2.038)	(1.813)	(1.537)	(1.039)
LL	566.391	477.898	567.084	607.575	601.438	563.964	585.900	584.052	483.188
AIC	-0.982	-0.828	-0.983	-1.053	-1.042	-0.977	-1.015	-1.012	-0.837
SC	-0.977	-0.824	-0.978	-1.049	-1.038	-0.973	-1.011	-1.008	-0.833
No of obs.	1152	1152	1152	1152	1152	1152	1152	1152	1152

Block C: RMB Exchange Rate Determination over Selected Horizons						
	1 day	1 week	1 month	1 quarter	6 months	1 year
USD	0.995***	0.992***	0.987***	0.982***	0.975***	0.982***
	(994.622)	(992.013)	(986.748)	(981.805)	(975.316)	(982.444)
Const	0.006***	0.011***	0.018***	0.017***	0.006***	0.019***
	(4.375)	(7.905)	(10.452)	(9.645)	(3.214)	(10.649)
LL	4555.843	4931.476	4941.794	4860.654	4743.603	4080.285
AIC	-7.908	-8.56	-8.578	-8.437	-8.387	-8.317
SC	-7.903	-8.555	-8.573	-8.433	-8.382	-8.312
No of obs.	1152	1152	1152	1152	1152	1152

Note: z-statistics are reported in parentheses.
* (**) [***] stands for significance at the 10% (5%) [1%] level.

Next we include all other currencies (EUR, JPY, KRW, and THB) into equation (3.1). The estimated parameter for the USD remains robust, but the confidence bands expand (see Figure 3.2) if more currencies are included. It is interesting to note that the specification with the euro shows a stabilization of the weight of the USD in 2014, but its increase in the summer of 2012 is less pronounced. This may indicate that RMB appreciation against the USD was caused by the development of the EUR and possibly other currencies as well. Moreover, we can see that the estimated implicit weights for the EUR decrease over the sample period and the weight is not significantly different from zero. The deepening of the sovereign debt crisis in the EMU and increasing uncertainties regarding the future of the common currency are mirrored in declining coefficients for the euro, which converges to zero at the time when the sovereign debt crisis peaked in the summer of 2011. Adding the JPY to equation (3.1) does not alter the previous results regarding the USD but we cannot observe any time-varying behaviour of the weight attached to the JPY. The pattern of the KRW looks quite similar to the one of the EUR. Finally, the THB reveals a positive and statistically significant weight. Compared to the first period of managed floating (Fidrmuc et al., 2010) this represents a major policy change and illustrates the increasing importance of one major Asian currency.

Figure 3.2: Time-varying Weights and Confidence Bands, AUD as Reference Currency, June 2010 to November 2014



Finally, we estimate equation (3.1) including all currencies available. It is notworthy that across specifications the pattern of the USD remains fairly unchanged (see Figure 3.2, last column) and the THB enters each estimation with a positive and statistically significant weight. Thus, the results for the USD are highly robust and deviations from the gradual decrease in the weight attached to the USD correspond to major political and economic events in the United States, namely the presidential elections in 2012 and the FED's decision reduce the purchase of asset-backed securities in December 2013.

3.7 Robustness Analysis

3.7.1 Swedish Krona as Reference Currency

Block B of Table 3.2 shows the final state estimates of equation (3.1) using the Swedish krona as reference currency, the corresponding figures of the time-varying weights and confidence intervals are available upon request. Compared with using the AUD as a reference currency the decline of the weight attached to the USD is much more gradual. However, the recent stabilization which coincides with tapering of the FED is still easily observable by visual inspection. The main difference between the use of the different reference currencies is that the EUR is statistically significant and takes on a negative sign. This finding might be attributed to the orientation of the SEK towards the EUR.

3.7.2 Time Horizon of Exchange Rate Policy

Exchange rate policy in general is likely to follow short-term, medium-term and long-term objectives. The advantage of our approach is that we can analyze the stabilization of the exchange rate in different time horizons. In particular, equation (3.1) can be transformed to growth rates over a period of τ trading days,

$$\frac{e_{rmb/cur,t}}{e_{rmb/cur,t-\tau}} = \alpha + \sum_{k=1}^{K} \omega_{k,t} \frac{e_{k/cur,t}}{e_{k/cur,t-\tau}} + \epsilon_t, \tag{3.3}$$

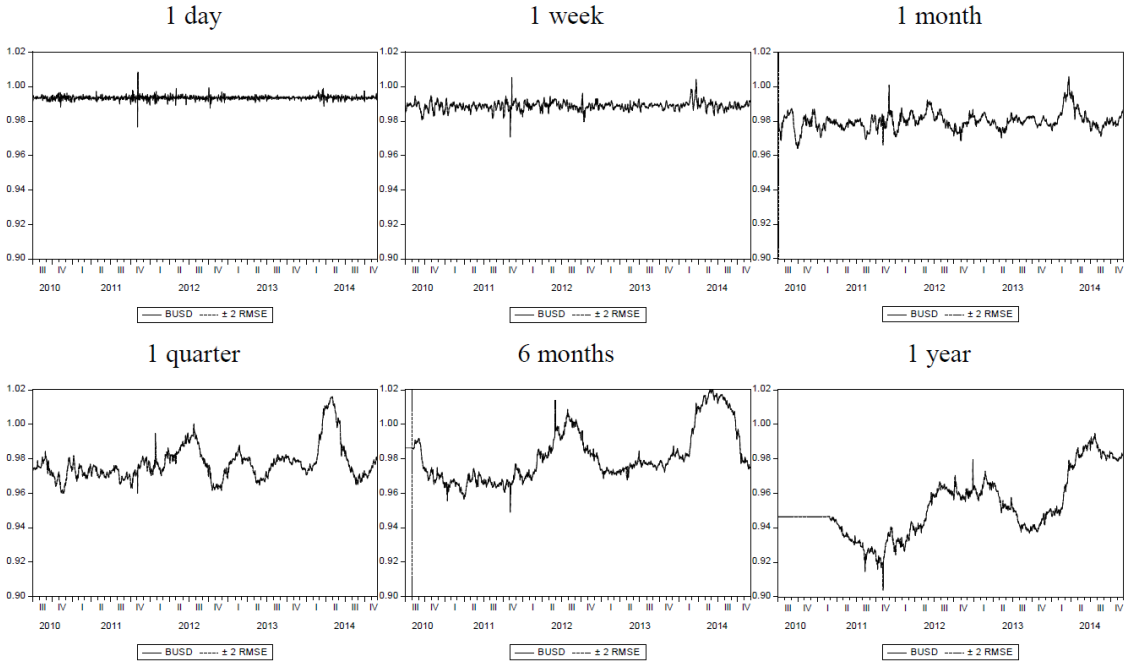
where the remaining parameters are defined similarly as in equation (3.1). The previous analysis showed that the euro, Korean won and Thai baht could play some role in the Chinese exchange rate policy, however, the estimated weights remained very close to zero during the whole period. Therefore, we concentrate here only on the role of the US dollar.

In Block C of Table 3.2, we present the impact of the USD exchange rate on the RMB exchange rate over selected time horizons: one trading day, one week (that is, five days), one month (20 days), one quarter (60 days), six months (150 days), and one year (300 days). This analysis reveals several interesting insights for the possible horizons of Chinese exchange rate policy. First, the focus of the Chinese exchange rate policy on the US dollar is incomplete which means a coefficient below one. The estimated coefficients are statistically significantly different from zero for all analyzed time horizons. The difference is closer to one for shorter periods. Thus, the estimated coefficient is 0.995 for the horizon of one trading day, 0.975 for one month, and 0.95 for one year. Second, there is little structural change if short-term fluctuations (one day or one week) of the exchange rate are analyzed, while exchange rate changes cumulate if the analyzed period is longer than one month (see Figure 3.3).

Third, we can see that for longer horizons coefficient variability increased in 2013 and 2014. This confirms that there was a gradual liberalization of exchange rate policy. Finally, only the analysis for the one year horizon shows a clear distinction between exchange rate behavior before and after June 2010. In sum, it seems that short term horizons of less than one month dominate the exchange rate policy in China. This finding is further supported by the information criteria, which also favor the specification of exchange rate growth over a horizon of one month.

In further analysis, we estimated the impact of all currencies on the RMB exchange rate over different time horizons. Although some currencies, especially the Thai baht, had significant weight for the levels, the impact of these currencies remained zero and insignificant if growth rates were considered. This indicates that the positive

Figure 3.3: RMB Exchange Rate Determination over Selected Horizons, June 2010 to November 2014



weights of these currencies in the levels may be due to other factors, for example due to orientation of these currencies towards the US dollar and the impact of regional or global unobservable factors on all analyzed currencies.

3.8 Conclusion

Economic policy announcements often differ from perceived *de facto* policy. There are numerous examples among developed and emerging economies. Among the latter, the Chinese exchange rate policy belongs to the cases which attracts significant attention in economic research and policy. The political discussion is mainly driven by the USA due to its trade deficit, but also by the rising importance of global imbalances in the aftermath of the financial crisis. Since June 2010, the exchange rate of the RMB has been declared to follow a managed floating regime after being re-pegged to the USD with the onset of the US sub-prime crisis. This reform was met

internationally with a high degree of skepticism due to the experience of a rather insufficient exchange rate liberalization between 2005 and 2008.

We analyze this second regime of managed floating after the financial crisis. Indeed, we confirm again the dominant role of the USD also during the recent period, but observe a declining weight attached to the USD between 2010 and 2014. Generally, through this second regime of managed floating, the gradually declining weight attached to the USD is accompanied by a gradual appreciation of the RMB against the USD. However, a temporary increase of the weight attached to the USD in early 2014 corresponds with a depreciation of the RMB against USD at the beginning of 2014. In addition, we find that major political and economic events in the United States coincide with deviations from the gradual decline of the weight attached to the USD through this second regime of managed floating after the financial crisis.

The EUR played some role at the beginning of the recent period of managed floating or before the peak of the European debt crisis, respectively, and possibly also during the presidential elections in the US in 2012. Although the results are very similar for the JPY, the estimated coefficient for JPY remains insignificant during the whole period analyzed. However, significant weights are found for the Thai baht which represents a major policy change compared to the first period of managed floating.

Independently from the different currencies included and the choice of the reference currency, the results obtained for time-varying weights attached to the USD reveal a consistent picture. Hence, the conduct of the Chinese exchange rate policy remains largely unchanged, meaning that it is focusing almost solely on the USD but allowing for a gradual appreciation of the RMB vis-*à*-vis the USD.

Chapter 4

Institutions and Creative Destruction in CEECs: Determinants of Inefficient Use of Assets

4.1 Abstract and Details of the Article

4.1.1 Abstract

We analyze the relationship between institutional quality and firm efficiency. Using rich data on firms in the European Union between 2005 and 2012, we show that high institutional quality lowers the share of persistently inefficiently used assets. This adverse effect of low institutional quality may be one of the narrow channels through which institutions affect income per capita in the long-run. Our approach combines institutional economics and Schumpeterian creative destruction. In addition, we observe similarities between inefficiently used assets in Europe and the phenomenon of zombie lending in Japan during the last decades.

JEL Classifications: O43, K23, C33.

4.1.2 Details of the Article

This article is joint work with Jarko Fidrmuc.[1] I presented it at the following conferences:

- 8th Biennial Conference of the Czech Economic Society, Prague/ Czech Rebuplic, November 2014.
- 1st International Research Conference on Macroeconomic Policies and Financial Stability Issues in Emerging Markets, Baku/ Azerbaijan, November 2014.
- Annual Meeting of the European Public Choice Society 2015, Groningen/ Netherlands, April 2015.
- Spring Meeting of Young Economists 2015, Ghent/ Belgium, May 2015.
- The 13th INFINITI Conference on International Finance, Ljubljana/ Slovenia, June 2015.
- 7th Joint IOS/APB/EACES Summer Academy on Central and Eastern Europe, Tutzing/ Germany, July 2015.

4.2 Introduction

Institutional quality is generally believed to be an important precondition for both long-term growth and per capita income (Acemoglu and Robinson, 2012). Nonetheless, there are numerous examples that countries with low institutional quality can grow fast as well. The most prominent examples include the Soviet Union in the 1950s and 1960s (Acemoglu and Robinson, 2012) or, more recently, China more recently. However, the former example illustrates that growth in countries with low institutional quality may stop suddenly and that it is difficult for these countries

[1]I would like to thank Magdalena Ignatowski, Richard Frensch, Jan Hanousek and the participants of several conferences for helpful comments and discussions.

to return to previous high growth dynamics. The recent literature has been putting more emphasis on the role of institutions related to economic growth and income per capita. And yet, institutions are manifold and often remain vague. Thus, a precise definition of institutions and the corresponding channels via which institutions impact long-run growth is mostly neglected by the literature.

Our empirical analysis confirms that more efficient institutions ensure a more efficient use of assets in the economy. We employ a very specific definition of institutional efficiency, namely institutions' ability to resolve insolvency. In general, weak institutions may reduce the ability as well as the incentives to clean up the economy from unproductively used assets and may be less successful in ensuring necessary competition. We propose that this adverse effect of weak institutions is one of the potentially many but narrow channels, through which institutions potentially affect income per capita in the long-run. We observe that insolvency resolving institutions are relatively weak in Central and Eastern European countries (CEECs) compared to mature economies like Germany, Austria, and Sweden. Our benchmark for efficiency at the firm-level is provided by the interest coverage ratio, as firms should be able to serve at least their interest payments from current earnings. Firms which fall below a specific threshold for one year or longer are potentially wasting the entrepreneurs' resources and suffer from severe inefficiency, since they have to provide interest payments from internal sources. The existence of such firms is facilitated by institutional weaknesses.

Motivated by this puzzle in institutional economics, we analyze the relationship between institutional quality and the efficient use of assets at the firm-level. Thereby, we propose a narrow channel, through which institutions potentially affect income per capita in the long-run. In particular, we investigate whether more efficient institutions, which are able to recover a higher share of assets in the case of firm insolvency, lower the share of unproductively used assets in the economy. The idea is that a better resolving insolvency framework facilitates the re-allocation of re-

sources. In other words, an economy with more efficient institutions is more open to Schumpeterian creative destruction. Institutions, which assure that firms tying up unproductive assets can be resolved efficiently, contribute to income and productivity growth. We test the hypothesis of whether more efficient institutions lead to a more efficient use of assets in an economy. Indeed, our results confirm that institutional quality is important.

The issue of firm efficiency received a lot of attention at the beginning of the economic transition in CEECs, especially regarding the importance of privatization (Estrin et al., 2009; Djankov and Murrell, 2002; Campos and Coricelli, 2002). In contrast, the issue of severe firm inefficiency due to financing conditions has not been intensively analyzed in the more recent literature. In addition and to the best of our knowledge, the triangular relationship between domestic institutional quality, financing conditions and firm inefficiency has been omitted from the discussion as well. Thus, our contribution closes this gap in the recent literature. Through the analysis of this severe form of firm inefficiency, our paper contributes indirectly to the growth literature. We aim to address the relationship between the institutional ability to resolve insolvency and the use of assets at the firm-level. Moreover, our study contributes to the discussion regarding European integration, since there are substantial differences in institutional quality between EU countries. Finally, by addressing basically macroeconomic issues with the use of micro data, our approach is closely related to a current methodological trend in economics (Buera et al., 2014; Gollin et al., 2014; Kaboski et al., 2014).

4.3 Literature Review

4.3.1 Competition, Institutions and Growth

4.3.1.1 Competition and Growth

Nickell (1996) finds that competition, as measured by the number of competitors, is associated with a significantly higher growth rate of total factor productivity growth. Since innovations matter with respect to productivity, another relevant finding is that less competitive industries generate fewer aggregate innovations, but that at the firm-level those firms with a higher market share tend to be more innovative (Blundell et al., 1999). Also at the firm level, Aghion et al. (2005) show that the relationship between competition and innovation follows a hump-shaped pattern. In addition to empirical analyses at the firm or industry levels, Dutz and Hayri (2000) provide a cross-country study, which indicates that the effectiveness of antitrust and competition policy enforcement is positively associated with long-run growth. Aghion et al. (2008) find that high mark-ups or low-level product competition, respectively, have a large negative effect on productivity growth in the South African manufacturing industry.

To sum it up, the relationship between competition and growth differs, depending on whether it is considered at the firm-level or at an aggregated level. The narrow channel we propose here, through which resolving insolvency institutions potentially affects growth in the long-run, relies on the connection of competition and growth at the aggregated level.

4.3.1.2 Institutions and Growth

Following seminal empirical contributions on growth (Mankiw et al., 1992; Levine and Renelt, 1992; Sala-i-Martin, 1997; Hall and Jones, 1999), Acemoglu et al. (2001) established the role of institutions in the empirical literature. By using European settler mortality rates as an instrument for current institutions in African coun-

tries,Acemoglu et al. (2001) show a large effect of institutions on income per capita. This initial contribution paved the way for an intense discussion of the relationship between institutions and income. Yet, this initial contribution is not exempt of criticism, see in particular Albouy (2012). However, Acemoglu et al. (2012) address the critique using an alternative formulation of their instrument that provides additional robust evidence for the long-run effect of institutions on income per capita. In additon, Glaeser et al. (2004) criticized the omission of human capital in Acemoglu et al. (2001). In response, Acemoglu et al. (2014) show that the impact of institutions on long-run development is robust with respect to historically determined differences in human capital. Moreover, Alesina and Giuliano (2013) find that culture matters for a variety of economic outcomes, based on analysing the relationship of culture with institutions. In addition, Acemoglu and Jackson (2014) emphasize the interplay between social norms and the enforcement of law.

However, institutions themselves remain a broad concept in the recent literature. The literature distinguishes between *de jure* and *de facto* institutions, which reflects the distinction between legal rules and their enforcement. Furthermore, there is still little understanding about the specific channels, through which institutions are influencing growth. Acemoglu et al. (2014) describe institutions as fundamental determinants in a causal chain working through channels but also concede that (p. 28): "Most empirical literature on this topic is agnostic about channels via which institutions impact long-run development [...]".

4.3.2 Institutional Quality

In the empirical literature there are many approaches to measure the "quality of institutions" as a numerical variable for use in further analyses. The Political Risk Services report an index reflecting protection against expropriation. This index is commonly used, brought forward, for example, by Acemoglu et al. (2001). However, Glaeser et al. (2004) criticize that a country under dictatorship can achieve the same level of protection against expropriation as a democratic country, in terms of this

index. Further examples are the Polity IV dataset, which provides a measure of democracy, and the World Bank's Worldwide Governance Indicator, which reports on six dimensions of governance for more than 200 countries. Besides these well-known measures, many additional measures are constructed to gauge the "quality of government" related to the functioning of the public sector, efficiency of bureaucracy, corruption etc. From a similar perspective, La Porta et al. (1998) emphasize the role of legal origins with respect to current investor protection.

In our empirical analysis we will employ an index provided by the World Bank, which is conceptually grounded on Djankov et al. (2008). Using data on time, cost, and the likely disposition of assets, Djankov et al. (2008) construct a measure of the efficiency of debt enforcement for 88 countries. In order to construct the index, they confront insolvency practitioners with a standardized case of an insolvent firm. The case assumes a midsize firm whose legal form is limited liability. It has one major shareholder and one large secured creditor. Hence, the firm will default on straight debt and there is no financial complexity, which could help to circumvent formal default. It is assumed that the firm could serve bank debt for the next two years but would then run into trouble, due its long-term inability to repay the debt. Employees want the firm to stay in business and the tax administration will follow the procedure that maximizes its expected recovery rate. There are three possible procedures in place, namely foreclosure, reorganization, and liquidation. Liquidation can be followed by two possible outcomes: going concern or piecemeal sale. The major benefit of the World Bank's methodology, as comapred to other measures, is that it provides a recurrent and comparable measure that differs depending on the country-specific design of institutions.

Based on this example, Djankov et al. (2008) provide a measure of institutional efficiency, which is defined as the present value of the firm's terminal value after bankruptcy costs, referred to as the *recovery rate*. This measure does not only reflect the institutional quality. We understand this measure to also reflect the incentives

of different parties at stake when considering whether to enter formal bankruptcy. Thus, a higher recovery rate means that different parties at stake may initiate a formal bankruptcy procedure sooner rather than later. In addition, the design of such institutions related to formal bankruptcy has *ex ante* effects on firms' performance, due to its influence of firms' capital structure (Stiglitz and Weiss, 1981). Finally, institutional quality proxied by the institutional ability to resolve insolvency is neither perfectly related to institutions-as-equilibria nor institutions-as-rules.[2]

4.3.3 Hypothesis

The IMF (2013) proposes an intuitive measure to identify firms facing debt-servicing difficulties and describes such firms as (p. 32): "These firms would be unable to service their debts in the medium term unless they make adjustments such as reducing debt, operating costs, or capital expenditures." Correspondingly, such firms cannot use their assets efficiently, which in turn causes a severe inefficiency at the firm-level and negatively affects potential growth for the whole economy.

We hypothesize that economies with more efficient institutions in terms of resolving insolvency suffer less from unproductive assets tied up in firms with debt-servicing difficulties. A lower recovery rate creates an incentive to keep a firm operating even if its assets cannot be employed most productively anymore. Thereby, market entry of new firms is hindered, which is economically not undesirable, since it prevents the re-allocation of resources. More efficient insolvency resolving institutions ensure that the operation of such firms will not be artificially prolonged and that the share of assets employed in inefficient firms will be lower. This makes the economy more Schumpeterian creative destruction, since it facilitates market entry and the corresponding re-allocation of resources. According to Schumpeterian growth theory[3], market entry is desirable, since the ensuing reallocation of resources from incumbents to new entrants is one major source of productivity growth (Aghion et al.,

[2]See Alesina and Giuliano (2013) for a discussion of both definitions.
[3]See Aghion et al. (2015) for a summary and predictions.

2013). In other words, a better resolving insolvency framework is proposed to enhance creative destruction. In turn, one could argue that the Schumpeterian theory of creative destruction implies a harmful effect of high competition on growth. However, recent empirical analyses[4] confirm this relationship at the firm level, but reveal a positive correlation between productivity growth and competition at the industry level; the corresponding theoretical modification is provided by Bento (2014). In addition, Chun et al. (2008) show a positive empirical link between creative destruction and industry-specific productivity. Our interpretation of weak resolving insolvency frameworks as a subsidy to incumbents is in line with the arguments presented by Acemoglu et al. (2013).

To sum it up, the narrow channel through which institutional quality is proposed to work here are those assets which are tied up in firms facing restrictions on employing their assets efficiently. Hence, we address the question of how the existence of these assets is influenced by the institutional ability to resolve insolvency.

Although different phenomena in their origins, we see many similarities between the described type of firms and so called "zombie firms". A zombie firm is defined as a firm which would become insolvent, if banks did not continue lending, referred to as "evergreening". Caballero et al. (2008) find that misdirected bank lending played a substantial role in extending the macroeconomic stagnation in Japan beginning in the 1990s. In their findings, they summarize how the existence of zombie firms causes the following economic consequences: first, they document a reduction of profits of healthy firms, which discourages market entry and investment; second, sectors dominated by zombie firms are often characterized by more depressed job creation and low productivity growth; finally, they find that even healthy firms generate depressed employment growth. These stylized facts indicate that zombie firms have significant negative spillovers on the remaining firms in the same sector and the overall economy. Giannetti and Simonov (2013) conclude from the Japanese phenomenon that

[4]See our discussion of subsection 4.3.1.1 above.

bank bailouts characterized by insufficiently large capital injections during a banking crisis have encouraged the evergreening of nonperforming loans, which differs from our definition of firms which are restricted in employing their assets efficiently.

4.4 Data and Descriptive Statistics

4.4.1 Country Selection

We collect detailed firm data for twelve member states of the European Union – namely Austria, Bulgaria, Czech Republic, France, Germany, Hungary, Latvia, Poland, Romania, Slovenia, Slovak Republic, and Sweden. We selected these countries because they show large differences in institutional quality. Moreover, institutions in Central and Eastern European Countries (CEECs) have improved mainly stepwise as a part of the accession to the EU, which included the adoption of the acquis communautaire. Thus, institutional quality can be viewed as somewhat exogenous in these countries.

Some CEECs could not be included, due to limited data availability. We include Austria, France, Germany, and Sweden as examples of mature developed economies in the European Union, which represent different origins of law (La Porta et al., 1998). Relatively detailed firm data are available from 2005 to 2012 for all countries in the sample except Latvia, for which data is only available from 2008 to 2012.

We forgo including other mature developed economies in the European Union, in order to avoid biased results caused by firms suffering from inefficiencies due to a domestic banking crisis. We consider the existence of "zombie firms" as more likely in the European periphery than in those mature developed economies included here. Bank loans subject to "evergreening" lead to a misidentification of firms with debt-servicing difficulties and, thus, would bias our results.

4.4.2 Institutional Quality Index

The World Bank provides various indices of governance and institutional quality. Among them, the efficiency of insolvency frameworks across economies is chosen for our analysis, as was described in more detail above. It is measured by the recovery rate of creditors in case of insolvency. A higher recovery rate of creditors in case of insolvency reflects more efficient institutions (Djankov et al., 2008). The recovery rate of creditors naturally ranges between 0 and 1 which corresponds to 0 and 100 per cent.[5] Table 4.1 provides an overview of the World Bank index. The arithmetic mean of the recovery rate across countries and years is roughly 0.47 and the median is 0.42; the minimum average recovery rate is 0.23 (Romania) and the maximum is 0.82 (Germany). Taking into account the development over time among the CEECs, even though overall still having weak institutional quality, Romania and the Czech Republic improved considerably between 2005 and 2012. Slovenia and the Slovak Republic made progress as well. Bulgaria, Hungary, Latvia, and Poland seem to be stuck at an institutional quality level below the median. On average more than half of the value of a resolved firm is lost in CEECs. The fact that French institutional quality is below that of Germany, Sweden, and Austria is assumed to be due to different origins of law (La Porta et al., 1998).

[5]The World Bank describes the relevance of its indicator as: "When a weak insolvency framework does not provide for effective formal and out-of-court mechanisms to address financial distress, more debts remain unsolved and more companies languish, unprofitable but with their assets unavailable to their creditors and little chance of turnaround."

Table 4.1: World Bank Index

Year	AUT	BUL	FRA	GER	HUN	LTV	POL	ROU	SVK	SLV	SWE	CZE
2005	0.725	0.335	0.457	0.832	0.379	0.359	0.324	0.069	0.396	0.424	0.723	0.168
2006	0.733	0.335	0.476	0.810	0.357	0.339	0.321	0.175	0.386	0.440	0.749	0.178
2007	0.737	0.344	0.480	0.812	0.397	0.348	0.338	0.199	0.481	0.449	0.757	0.185
2008	0.724	0.324	0.474	0.816	0.384	0.346	0.337	0.289	0.452	0.466	0.747	0.213
2009	0.715	0.321	0.447	0.802	0.384	0.290	0.341	0.295	0.459	0.455	0.751	0.209
2010	0.715	0.321	0.447	0.802	0.384	0.290	0.341	0.285	0.459	0.455	0.751	0.209
2011	0.731	0.310	0.452	0.816	0.379	0.319	0.358	0.257	0.553	0.509	0.773	0.559
2012	0.727	0.314	0.458	0.827	0.392	0.464	0.315	0.286	0.543	0.511	0.758	0.560
country mean	0.726	0.326	0.461	0.815	0.382	0.344	0.334	0.232	0.466	0.464	0.751	0.285
overall min	0.232	(ROU)										
overall mean	0.466											
overall median	0.422											
overall max	0.815	(GER)										

Note:
(1) 1.00 equals a recovery rate of 100%.
(2) Source: World Bank Doing Business.

4.4.3 Firm-Level Data

We focus on non-listed companies. In order to avoid financial complexity, we additionally restrict our analysis to companies whose debt is fully bank financed. Firstly, this corresponds closely to the example of the insolvent firm discussed by Djankov et al. (2008). And secondly, this group of firms also represents the most important domestic firms in the CEECs, where domestic capital markets are generally underdeveloped and access to international capital markets is limited. In general, data collection is as closely as possible in line with the standardized case of an insolvent firm by Djankov et al. (2008). We use the Amadeus databank provided by the Bureau van Dijk, which provides detailed data for European firms, including balance sheets, profit and loss accounts, the legal form, and the industrial code (Nace, Rev. 2). Industrial codes are used for sectoral aggregation. We use the following information for each firm: cash flow (CF), total assets (TA), long-term debt (LTD), short-term debt (STD), interest expenses (IE), depreciation (DP), and earnings before interest, taxes, depreciation and amortization (EBITDA). Based on these data, we define the interest coverage ratio, ICR_{it}, for each firm i in each period t, which equals

$$ICR_{it} = \frac{EBIT_{it}}{IE_{it}}, \tag{4.1}$$

where $EBIT_{it}$ equals $EBITDA_{it}$ minus DP_{it}. Brealey et al. (2008) call this ratio time-interest-earned and describe it as a measure of "how much clear air there is between hurdle and hurdler". This means that current earnings should cover at least the interest expenses, otherwise internal financing sources of the firm have to be used for repayment. Therefore, the ICR will be the key variable for further analysis and we will use it for our definition of firms that tie up assets in inefficient uses. The explanatory variables at the firm-level are cash flow divided by total assets, CF/A, as well as debt[6] divided by total assets, D/A, and follow the findings of the previous literature (Benito and Whitley, 2003; Mojon et al., 2002). In total, we collect

[6]Debt equals long-term debt plus short-term debt.

roughly 1.5 million observations across countries between 2005 and 2012. Table 4.2

Table 4.2: Pairwise Correlation

	ICR	CF/A	D/A	$INST$
ICR	1.000			
CF/A	0.024*	1.000		
D/A	-0.019*	-0.280*	1.000	
$INST$	0.022*	-0.001	0.013*	1.000

* denotes significance at the 5%-level.

shows pairwise correlation coefficients of the analyzed variables using individual data. The ratio of cash flow to total assets is positively and statistically significantly correlated with the interest coverage ratio. Debt to total assets ratio is negatively and significantly correlated with the interest coverage ratio. Hence, both variables are correlated with the interest coverage ratio as expected. The recovery rate of creditors, which is employed in order to proxy institutional quality, is positively correlated with corporate financial health, which also confirms our expectations.

Table 4.3 illustrates differences between healthy firms and firms with an ICR below one, whereby a comparison of group means with *t-tests* reveal intuitive results. Firms with an interest coverage ratio below are more indebted. Furthermore, comparing firms facing debt-servicing difficulties only during one period with those facing debt-servicing difficulties for more than one period provides some interesting findings that are also shown in Table 4.3. Firstly, firms facing debt-servicing difficulties for more than one period are larger and more indebted, but not significantly less liquid. Secondly and surprisingly, they do not face much tougher financing conditions, even though they are more indebted: the implicit lending rate, which equals interest expenses divided by outstanding bank debt, does not differ between those two groups of weak firms. In case our hypothesis holds, this can be interpreted as a lower recovery rate of creditors facilitating "evergreening".[7]

[7]This is where we see once again similarities to the arguments presented by Caballero et al. (2008) but also a major difference, since our results do not reflect evergreening of nonperforming loans, due to insufficient bank bailouts like in Japan (Giannetti and Simonov, 2013).

Table 4.3: Characteristics of an ICR < 1.

Mean	All Firms	Group 1	Group 1 vs. All Firms	Group 2	Group 2 vs. All Firms	Group 2 vs. Group 1
EBITDA	1429.813	ICR<1 for one period	-738.528	ICR<1 for two consecutive periods	-896.048	
t-value			(28.008)		(21.651)	(5.062)
Interest Expenses	313.626		1006.124		1555.345	
t-value			(-5.762)		(-7.446)	(-1.446)
Implicit Lending Rate	0.040		0.171		0.131	
t-value			(-7.160)		(-3.583)	(0.693)
ST Debt	4984.730		8299.663		11557.560	
t-value			(-20.478)		(-29.269)	(-12.675)
LT Debt	4916.609		6956.277		9552.258	
t-value			(-8.998)		(-14.740)	(-8.549)
Cashflow	1036.780		-528.828		-545.818	
t-value			(26.745)		(19.483)	(0.215)
Total Assets	15016.110		22010.190		31066.450	
t-value			(-14.004)		(-23.166)	(-11.922)
Cashflow/Assets	0.097		-0.151		-0.155	
t-value			(117.819)		(85.822)	(0.913)
Debt/Assets	0.714		1.046		1.114	
t-value			(-150.000)		(-130.000)	(-12.133)
LT_Debt/Assets	0.218		0.322		0.361	
t-value			(-21.561)		(-21.404)	(-14.096)
ST_Debt/Assets	0.496		0.724		0.753	
t-value			(-46.094)		(-37.523)	(-6.190)

Notes: The t-statistic is reported in parentheses. Null hypothesis is diff=0 where diff equals mean(0)-mean(1) and 1 represents the specific section.

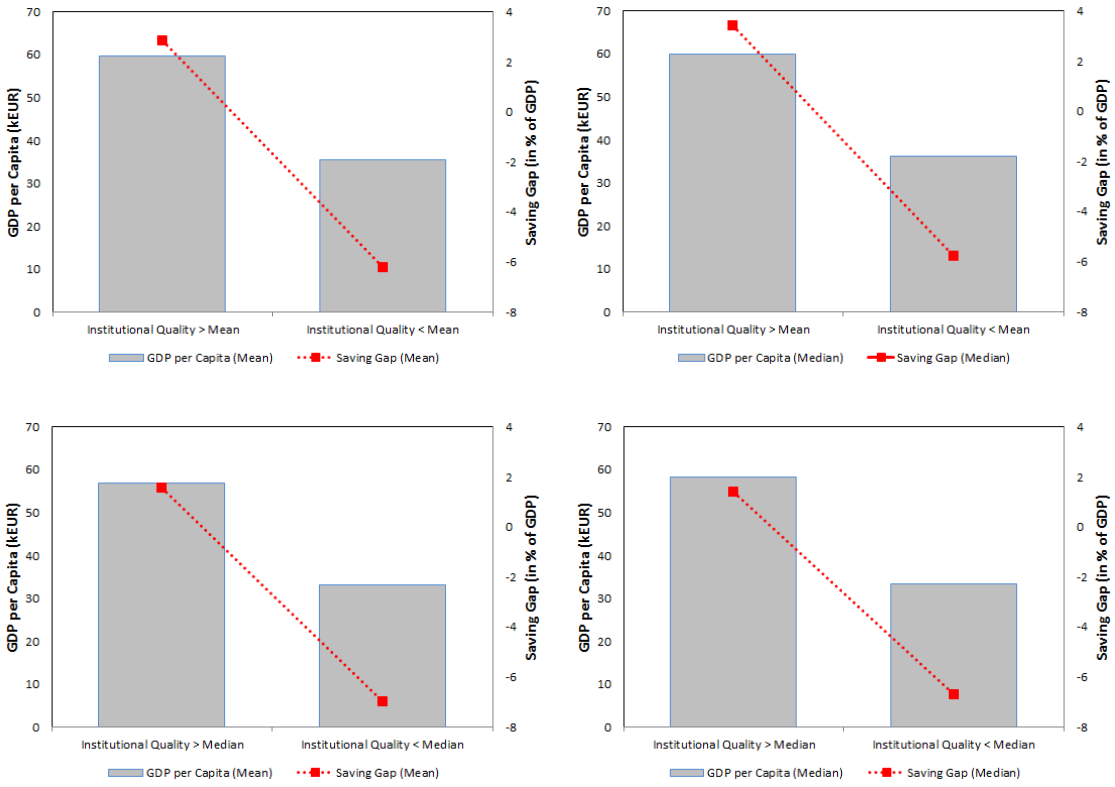
The puzzling fact that firms which face financial distress but are still operating are larger than healthy firms might be attributed to the political willingness to keep large firms operating. Another possible explanation could be loss aversion of stakeholders (Kahneman and Tversky, 1979; Odean, 1998).

4.4.4 Macroeconomic Data and Cross-Sectional Relationship

The next step of our analysis lies in the comparison of microeconomic and macroeconomic data. Macroeconomic data are taken from the World Economic Outlook Database of the International Monetary Fund (real growth rate of GDP, total investment as share of GDP, and gross national savings as share of GDP) and from the Ameco Database provided by the European Commision (GDP at current market prices per person employed).

The long-run correlation between institutions and GDP per capita is relatively well understood in the literature. Since we proxy institutional quality by the recovery rate of creditors, we first have to test whether our measure satisfies this long-run relationship in the cross-section of analyzed countries. We take GDP at current market prices per person employed as a productivity indicator. In a Schumpeterian sense, productivity ought to be higher in countries with higher competition. In addition, we include a "savings gap" which equals gross national saving (as a share of GDP) less total investment (as a share of GDP). Figure 4.1 illustrates the following stylized facts: first, the mean/median of GDP per capita is higher for countries whose institutional quality is above the mean/median. Second, the mean/median of the savings gap is negative for countries whose institutional quality is below the mean/median.

Figure 4.1: Institutional Quality, GDP per Capita, and Saving Gap



Notes:

(1) Institutional quality is proxied by the resolving insolvency measure provided by the World Bank.

(2) Saving gap equals gross national saving (in % of GDP) minus total investment (in % of GDP).

(3) GDP per capita equals gross domestic product at current market prices per person employed.

(4) Sources: Ameco, IMF, World Bank.

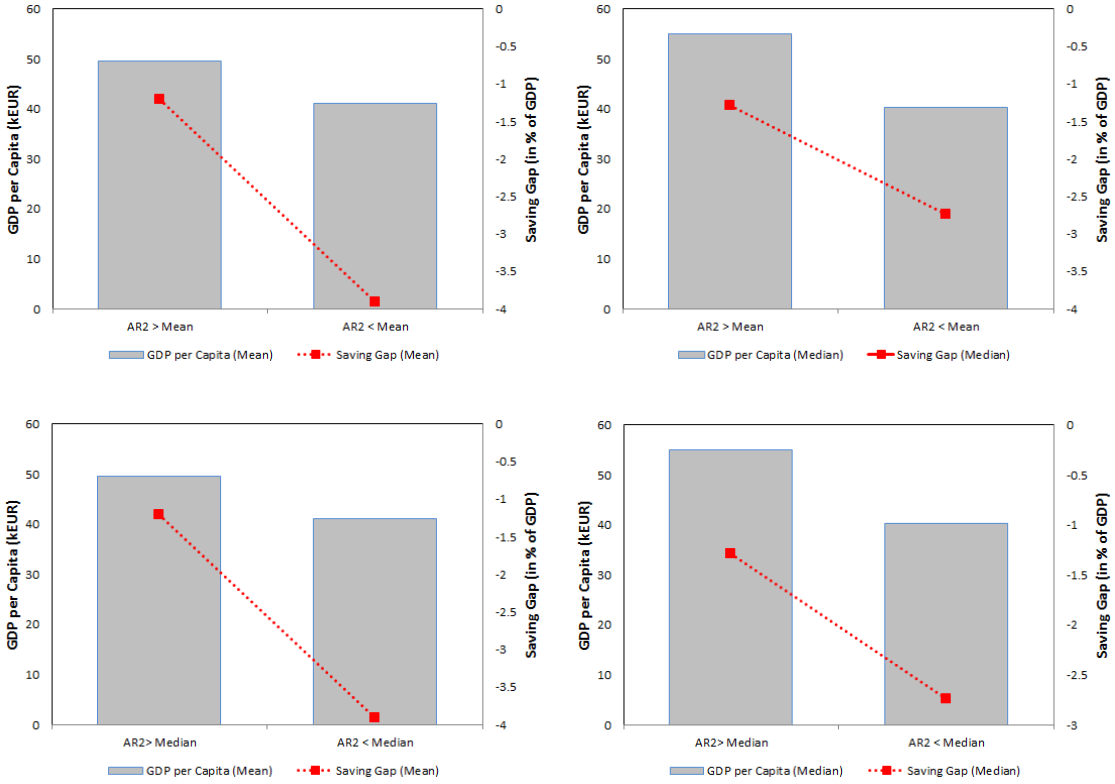
4.4.5 Sectoral Aggregation

In general, there are several channels through which institutional quality may affect economic performance in the long-run. We focus on the inefficient use of assets by firms facing debt-servicing difficulties. If a firm faces financial distress, defined by an interest coverage ratio below one, it will use internal sources to repay credits. In the long run, such firms will starve slowly to death and their assets will be fully wasted. Moreover, we distinguish between firms which face financial distress for only one period and those which do so for two consecutive observations. In this way, we try to distinguish between those firms with some and those with no long-term prospects, respectively.[8]

Using individual firm data, we define one sectoral variable of interest, *Asset Ratio*, as the ratio of assets tied up in firms facing financial distress aggregated for sectors within countries. The lower the share of assets tied up unproductively in an industry, the more open this industry is to the benefits of Schumpeterian creative destruction, such as market entry and the corresponding re-allocation of resources. This variable is constructed based on firms which face debt-servicing difficulties for either one period or two consecutive observations.

[8] According to Djankov et al. (2008), firm in the standardized case is able to serve bank debt for the next two years but then it will run into trouble, due its long-term inability to repay the debt.

Figure 4.2: Share of Assets Tied Up in Weak Firms, GDP per Capita, and Saving Gap



Notes:

(1) AR2 measures the share of assets tied up for two consecutive observations in weak firms.

(2) Saving gap equals gross national saving (in % of GDP) minus total investment (in % of GDP).

(3) GDP per capita equals gross domestic product at current market prices per person employed.

(4) Sources: Amadeus, Ameco, IMF, World Bank.

The measure of main interest is the *Asset Ratio* for two consecutive observations. Our intuition is that the longer the inefficient use of assets persists, the lower the growth potential of the economy, as reflected in GDP per capita. Thus, we expect the relationship between *Asset Ratio* and GDP to reflect characteristics observed in Figure 4.1. Figure 4.2 illustrates that the *Asset Ratio* for two consecutive observations indeed shares – even though less pronounced – the long-run characteristics of our proxy for institutional quality.

The amount of individual data is impressive, but its use does not yet directly address our research question. As discussed above, competition has a different impact at the firm-level than at the sector-level. With respect to formal bankruptcy, Maksimovic and Phillips (1998), for example, show that industry effects are important determinants of the frequency of bankruptcy and of economic decisions in bankruptcy. Thus, we construct sectoral aggregates and run analyses for sectors within countries. An additional advantage of this approach is that it gives us deeper information about country-specific sectoral effects.

As noted above, firms that face unsustainable debt-servicing difficulties and are thus not able to employ assets efficiently, are defined by an interest coverage ratio of below one either for one or for two consecutive observations. As the dependent variable, we calculate the share of assets tied up in these firms for each sector in each country each year, labelled as *Asset Ratio*, $AR_{p;s;t}$. p is either 1 or 2 depending on whether we use firms facing debt-servicing difficulties for one or at least two consecutive observations. s represents a specific sector in a country and t the year of observation. The measure for two consecutive observations, $AR_{2;s;t}$, will be our preferred indicator at the sectoral level. We drop sectors including less than 20 firms. Similarly, we aggregate cash flow and debt for sectors and divide them by sectoral total assets. Table 4.4 shows pairwise correlation coefficients of the most important variables employed. As can be seen, only the aggregated micro variables consistently show the expected correlation coefficient. However, the lower part of the table reveals

an interesting finding: the more efficient institutions are, the less persistently assets are tied up in weak firms.

Table 4.4: Pairwise Correlation, Sectoral Aggregation

	AR_1	AR_2	CF/A	D/A	$INST$
AR_1	1.000				
AR_2	0.912*	1.000			
CF/A	-0.343*	-0.298*	1.000		
D/A	0.190*	0.141*	-0.187*	1.000	
$INST$	-0.003	0.057*	-0.130*	-0.038	1.000

	$(AR1 - AR2)$	$INST$
$(AR1 - AR2)$	1.000	
$INST$	-0.133*	1.000

* denotes significance at the 5%-level.

4.5 Estimation and Results

In order to identify the determinants of the share of assets tied up unproductively in sectors within countries empirically, we have to take into account the dynamic properties of the analyzed panel data. A fixed effects panel estimation would not be able to satisfy this criterion. Moreover, we need to consider possible reverse causality and endogeneity problems. In our baseline regression, we employ cash flow and debt both divided by total assets and institutional quality, proxied by the by the recovery rate of creditors, as independent variables. All may be endogenous in our estimations, e.g. due to reverse causality. For example, facing debt-servicing difficulties constraints cash flow. Another important concern is that financial distress is often highly persistent. Therefore, we control for the dynamic properties of our data by estimating a dynamic panel model:

$$AR_{p;s;t} = \alpha_{p;s} + \sum_{l=1}^{L} \delta_p AR_{p;s;t-l} + \sum_{k=1}^{K} \beta_k X_{s;t} + Z_{s;t}\gamma + \epsilon_{p;s;t}. \tag{4.2}$$

The dependent variable in equation (4.2) $AR_{p;s;t}$ is the Asset Ratio of firms facing debt servicing difficulties for a sector within a country as already described. δ are autoregressive parameters for L lags of the share of assets tied up unproductively in

sectors within countries. X includes the three potentially endogenous independent variables of our baseline regression, namely cash flow and debt both divided by total assets and the recovery rate of creditors. Z includes additional control variables. We also control for recessions using a binary variable. A recession is defined as a negative annual growth rate.[9] We control for different institutional indices other than the recovery rate of creditors.[10] Since different measures of institutional quality are normally correlated within countries, it is important to show that our results are not driven by the "general" level of institutional quality. Therefore, we control for measures of getting credit and the enforcement of contracts: first, $Strength\ of\ Legal\ Index$ which measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending; second, $Depth\ of\ Credit\ Information\ Index$ which measures rules affecting the scope, accessibility, and quality of credit information available through public or private credit registries; third, $Enforcing\ Contracts$ which assesses the efficiency of the judicial system by following the evolution of a commercial sale dispute over the quality of goods by tracking the time it takes in days. Moreover, we calculate a Herfindahl-style Competition Index (CI) for sectors based on $EBITDA$. The calculated Competition Index is by definition a sectoral variable. However, a Competition Index based on the EBITDA of firms in our sample does not necessarily capture sectoral competition appropriately. Firms in our sample also compete at a sectoral level with firms that are not only bank financed and public firms, both of which are not included in our sample data. In addition, we control for time and country effects by dummies. ϵ represents the residual.

An OLS estimate may be significantly biased when the number of time periods is small (Baltagi, 2008) because the lagged values of the dependent variable, $AR_{p;s;t-l}$, are correlated with the fixed effects, $\alpha_{p;s}$. Therefore, Arellano and Bond (1991) propose a GMM (General Methods of Moments) estimator which removes fixed effects

[9] This should be more or less identical to negative growth rates over two consecutive quarters, which is the standard definition of recession.

[10] All indices used are provided by the World Bank.

by difference transformation (difference GMM). However, the difference transformation leads to the so called weak instrument problem when the dynamic terms are close to unity. Arellano and Bond (1995) and Blundell and Bond (1998) builds a system of two equations (system GMM) in levels and in first differences. We use two lags of each of the endogenous variables for the system GMM estimations. Time effects are included as exogenous instruments.

Table 4.5: System GMM, Asset Ratio one Period, 2005 - 2012

	(I)	(II)	(III)	(IV)	(V)	(VI)
dependent variable	AR1	AR1	AR1	AR1	AR1	AR1
$DependentVariable_{t-1}$	0.284***	0.284***	0.264**	0.285***	0.291***	0.278***
	(0.095)	(0.095)	(0.105)	(0.095)	(0.099)	(0.091)
Cash Flow/Assets	-0.825**	-0.745**	-1.055**	-0.823**	-0.796**	-0.855**
	(0.372)	(0.356)	(0.507)	(0.372)	(0.390)	(0.375)
Debt/Assets	0.313**	0.318**	0.284*	0.313**	0.314**	0.298*
	(0.159)	(0.160)	(0.161)	(0.159)	(0.159)	(0.160)
Institution	-0.162	-0.244*	-0.128	-0.157	-0.174	-0.164
	(0.128)	(0.148)	(0.128)	(0.127)	(0.125)	(0.126)
Recession		0.035				
		(0.025)				
Strength of Legal Index			-0.037			
			(0.032)			
Depth of Credit Information Index				-0.002		
				(0.022)		
Enforcing Contracts					0.000	
					(0.000)	
Competition Index						0.072
						(0.203)
Constant	0.001	0.005	0.245	0.009	0.091	0.009
	(0.157)	(0.157)	(0.302)	(0.193)	(0.186)	(0.157)
Time Dummies	yes	yes	yes	yes	yes	yes
Country Dummies	yes	yes	yes	yes	yes	yes
No of obs	1231	1231	1231	1231	1231	1231
No of groups	188	188	188	188	188	188
Hansen *p-value*	0.332	0.331	0.371	0.300	0.281	0.300
AR(1) *p-value*	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) *p-value*	0.745	0.726	0.718	0.747	0.762	0.679

Notes:
(1) * (**) [***] denotes significance at the 10% (5%) [1%] level.
(2) Robust standard errors are reported in parentheses.

Table 4.5 and Table 4.6 show the results of our estimation and reveal satisfying test statistics. Explaining the determinants of the share of assets tied up unproductively in sectors within countries for one year, Table 4.5 reveals a highly persistent dependent

variable. In addition to its persistence, the *Asset Ratio* is statistically significantly determined by the aggregated micro-variables. Liquidity, CF/A, reduces the share of assets tied up unproductively, whereas indebtedness, D/A, increases it. Thus, both variables enter our analysis with the hypothesized sign. Other variables employed, including the recovery rate of creditors, do not statistically significantly determine the dependent variable. However, we are more interested in the explanation of the share of assets tied up unproductively for at least two consecutive observations.

Table 4.6: System GMM, Asset Ratio two consecutive Observations, 2005 - 2012

	(I)	(II)	(III)	(IV)	(V)	(VI)
dependent variable	AR2	AR2	AR2	AR2	AR2	AR2
$DependentVariable_{t-1}$	0.386***	0.387***	0.382***	0.377***	0.381***	0.366***
	(0.132)	(0.134)	(0.134)	(0.131)	(0.133)	(0.130)
Cash Flow/Assets	-0.944**	-0.961**	-1.152**	-0.967**	-0.982**	-1.034***
	(0.415)	(0.401)	0.521	(0.418)	(0.436)	(0.397)
Debt/Assets	0.164	0.161	(0.102)	0.182	0.164	0.129
	(0.140)	(0.142)	0.140	(0.139)	(0.141)	(0.152)
Institution	-0.309**	-0.285*	-0.248*	-0.245*	-0.299**	-0.322**
	(0.142)	(0.172)	(0.128)	(0.135)	(0.141)	(0.139)
Recession		-0.009				
		(0.023)				
Strength of Legal Index			-0.043			
			(0.026)			
Depth of Credit Information Index				-0.035*		
				(0.021)		
Enforcing Contracts					0.000	
					(0.000)	
Competition Index						0.196
						(0.167)
Constant	0.174	0.173	0.456*	0.313*	0.077	0.194
	(0.139)	(0.140)	(0.257)	(0.186)	(0.156)	(0.143)
Time Dummies	yes	yes	yes	yes	yes	yes
Country Dummies	yes	yes	yes	yes	yes	yes
No of obs	1231	1231	1231	1231	1231	1231
No of groups	188	188	188	188	188	188
Hansen *p-value*	0.500	0.585	0.561	0.561	0.447	0.434
AR(1) *p-value*	0.000	0.000	0.000	0.001	0.000	0.000
AR(2) *p-value*	0.335	0.335	0.235	0.417	0.305	0.293

Notes:
(1) * (**) [***] denotes significance at the 10% (5%) [1%] level.
(2) Robust standard errors are reported in parentheses.

Table 4.6 again reveals a highly persistent dependent variable. Liquidity still reduces the share of assets tied up unproductively, but indebteness does not enter the

analysis significantly anymore. However, the recovery rate of creditors statistically significantly reduces the share of assets tied up unproductively for at least two consecutive observations. This finding is line with our hypothesis. The results can be interpreted to mean that aggregated micro-variables become less, but institutional quality becomes more important the longer assets are tied up unproductively.

4.6 Conclusion

The use of a rich dataset at the firm-level allows us to aggregate data across sectors within countries. We analyze a narrow channel through which institutions potentially affect income in the long-run – the institutional ability to resolve insolvency. We test whether the ability of institutions to resolve insolvency influences the existence of assets not used efficiently. In order to identify the determinants of inefficiently used assets at the sector level and to mitigate the corresponding endogeneity problem, we use the dynamic panel system General Method of Moments (GMM) estimator. Estimations provide satisfying test statistics. The share of assets tied up in firms facing debt-servicing difficulties for at least two consecutive observations is of main interest. We find that more efficient institutions reduce the share of assets tied up unproductively in firms facing debt-servicing difficulties for more than one year. This result is in line with our hypothesis and provides statistical evidence for a very specific effect of institutional quality in terms of resolving insolvency.

A further catch-up in terms of institutional quality by CEECs is highly recommended. Taking into account the fact that cross-border differences in institutions might be due to certain, country-specific cultural values, the implementation of institutional progress and, in particular, the enforcement of those changes are more challenging than they appear at first glance. Hence, we recommend imposing laws gradually, as proposed by Acemoglu and Jackson (2014), in order to allow social norms to adopt. Regarding the improvement of institutional quality, we also follow the advice of Djankov et al. (2008) that countries with weak institutions ought

to introduce relatively simple mechanisms, like foreclosure with no or limited court oversight and floating charge, which essentially transfers control of the firm to the secured creditor in the case of default. In addition, a side-benefit of institutional improvement is that better insolvency frameworks correlate with more developed financial markets.

Chapter 5

The Transmission of Bank Funding to Corporate Loans: Deleveraging in Germany

5.1 Abstract and Details of the Article

5.1.1 Abstract

Healthy banks are crucially important for smooth lending. Correspondingly, bank regulations including Basel III intend to create a strong financial sector. However, the higher capital requirements may also worsen the access to finance especially during the transition period. Using data on firm-bank relationships in Germany between 2005 and 2007, we show that the debt ratio of banks is related to the bank loan risk. In order to assess the potential effect of tighter capital requirements due to regulatory changes, we analyze industry specific responses of loan conditions to bank debt levels. Our findings imply that manufacturing, and to a lesser extent wholesale and retail trade, will potentially face a more restricted access to bank loans after the tightening of capital requirements.

JEL Classifications: G21, G28, C33.

5.1.2 Details of the Article

This article is joined work with Jarko Fidrmuc and Philipp Schreiber.[1] I presented it at the following conferences:

- Eurozone Future: From Crisis to Stabilization, Reform and Growth, Brno/ Czech Republic, November 2013.
- INFER Annual Conference, Pescara/ Italy, May 2014.
- 6th IFABS Conference: Alternative Futures for Global Banking: Competition, Regulation and Reform, Lisbon/ Portugal, June 2014.
- Econometric Methods for Banking and Finance Conference, Lisbon/ Portugal, September2014.

Since May 2015, this article is published in Open Economies Review: Vol. 26, Issue 3, pages 581-597.

5.2 Introduction

Bank lending is of crucial importance for economic growth and development. Only strong and healthy banks can provide sufficient loans for expanding firms. With the ongoing regulation in the banking industry it becomes increasingly important to study the effects of proposed regulatory changes (Cochrane, 2011). Proposed changes that potentially influence the refinancing opportunities of banks are particularly important for Germany. The German economy is characterized by a strong role of small and medium enterprises (SMEs) which are mainly financed through bank loans. Therefore, Germany represents an example of a bank-based financial system (Allen and Gale, 1995a). In addition, SMEs cannot easily substitute bank loans with

[1]We would like to thank Magdalena Ignatowski, Marcel Tyrell, Marcel Prokopczuk, Cordelius Ilgmann, Andrej Gill, Josef Korte, Chardin Wese Simon, Jakob de Haan, Jan Hanousek, Roman Horváth, Laurent Weil, Zuzana Fungáčová, and participants of several conferences for helpful comments and discussions.

corporate debt during a credit crunch (Giesecke et al., 2012). A country-specific analysis is not only justified by the characteristics of the German economy but also by the fact that there are cross-country variations with respect to the adjustment process of several variables in response to Basel III (IMF, 2013). Therefore, an assessment of the proposed regulations regarding Germany is necessary.

Our discussion on Basel III is motivated by the possible effects generated by the banks' tighter capital requirements on the economy. To address the potential impact of bank deleveraging, we use unique data on firm-bank relationships in Germany between 2005 and 2007. Debt ratio and short-term funding ratio are calculated from the balance sheet data, whereas the loan risk is proxied by implicit lending rates at the company level. In addition, we utilize information on the bank relationships of analyzed firms, which allows us to merge individual firm level data with the corresponding bank indicators. Furthermore, our multilevel modeling approach utilizes the information given by the structure of the data set with respect to different criteria. In particular, we use fixed effects and random effects for sectors, regions, banks, and firms. We try to identify industry specific effects of deleveraging, because banks will not reduce loans uniformly across the economy. Therefore, we estimate sector-specific sensitivity of loans to banks' debt ratio and identify the sectors that are likely to be influenced most by the ongoing regulatory changes.

Our empirical results reveal that the banks' debt ratio determines the lending conditions especially for manufacturing and to a lesser extent for wholesale and retail trade. Therefore, these industries will potentially be hit more by a regulatory change causing a decrease in banks' debt ratio. The extent of the transmission of bank funding to corporate loans for manufacturing firms is the major contribution of this study. Moreover, we provide an empirical insight into the connection between banks' financing and banks' granting of loans.

The paper is structured as follows. In the following section, we briefly describe Basel III regulations. In section 3, we review the previous literature on selected

aspects of bank lending and bank funding. Section 4 describes our data and explains how firm and bank data have been merged. Section 5 discusses the estimation and presents the empirical results. The final section concludes.

5.3 Basel III

In general, regulations on capital adequacy of banks should ensure that banks hold enough capital relative to bank risk. Capital requirements have to take into account negative externalities arising from bank defaults. In general, risk-based capital requirements can eliminate risk-taking incentives if risk weights are correctly chosen (Rochet, 1992; Kim and Santomero, 1988). However, Hellwig (2010) criticizes the illusion of measurability of risk whereas Blum (2008) emphasizes that the supervisor has to rely on banks' risk reports. In the aftermath of the financial crisis, regulatory authorities as well as financial intermediaries have put much attention to a reform of the regulation of capital requirements (Hellwig, 2010).

In December 2010, the Basel Committee on Banking Supervision published a comprehensive set of reforms aiming at strengthening the regulation, supervision and risk management of the banking sector, known as Basel III. Main changes in Basel III are reflected in the fields of capital requirement, risk coverage, leverage ratio, and liquidity. Revised capital requirements focus more on common equity, bringing the total common equity standard to 7% and including a countercyclical buffer within a range of 0 to 2.5%, comprising common equity. However, the main attention of the economic policy discussion has been attracted so far by the proposed reduction of the non risk-weighted leverage ratio to 3%. This reflects the criticism regarding potentially flawed model-based approaches, referred to as internal ratings based approaches. In Germany, as in other EU countries, the recommendations of the Basel Committee on Banking Supervision will be implemented via the Capital Requirements Directive IV (CRD IV) and the Capital Requirements Regulation (CRR). In

Germany, these reforms are accompanied by the German restructuring law (Schäfer et al., 2013).

5.4 Literature Review

5.4.1 Buffer Theory and Capital Requirements

The way banks adjust their balance sheets is crucial for the real economy (IMF, 2013). Buffer theory implies that if banks approach the minimum capital requirements, they will have an incentive to increase capital and reduce risk in order to avoid a punishment by the regulatory authority (Milne and Whalley, 2001; Marcus, 1984). On the one hand, many authors (Angelini et al., 2011; IMF, 2013; Kashyap et al., 2010; Rime, 2001) focus on capital increases necessitated by higher capital requirements. On the other hand, banks may also address higher capital requirements by a reduction of debt.

Using a survey aimed at identifying the impact of the Basel Accord, Jackson et al. (1999) find that banks are likely to reduce lending if either economic conditions are weak or issuing equity is costly. Hyun and Rhee (2011) analyze the effect of shareholder dilution on banks' decisions to meet capital requirements and show that banks prefer loan reduction over the issuance of new equity. However, if banks address higher capital ratios by raising equity which in turn increases their lending spread (Kashyap et al., 2010), the same industries could lose access to bank loans due to higher costs and due to the disappearance of banks' willingness to lend. In response to capital requirements, Rime (2001) finds for example that Swiss banks tend to improve their capital adequacy by increasing their capital (retained earnings, equity issues) and not by decreasing risk-taking. Considering large US institutions, Kashyap et al. (2010) find an increase in banks' lending spread if banks raise equity in order to comply with Basel III. Thus, deleveraging is generally expected to lead to higher lending rates or worse access to loans for some firms.

5.4.2 Bank Funding

Many scholars have been analyzing the role of bank funding and, in particular, the role of leverage and short-term funding. On the one hand, a series of contributions (Admati and Hellwig, 2013; Admati et al., 2011; Pfleiderer, 2010) favor regulatory limits on bank leverage. Their view is supported by the argument that excessive leverage was the primary cause of the financial crisis (Acharya et al., 2012; Adrian and Shin, 2010; Brunnermeier, 2009). However, this argument is not uniformly shared in the literature, van Wincoop (2013) is highly skeptical that the financial crisis was transmitted through leveraged financial institutions. In addition, DeAngelo and Stulz (2013) emphasize the need of high leverage for banks when liquidity is prized at a premium and banks generate value by producing liquid claims for financially constrained counterparties. Lé (2013) finds that between 1986 and 2011 the capital-to-assets ratio of banks has decreased by approximately 15% after the implementation of deposit insurance due to a pick-up in leverage by smaller banks.

In contrast to the role of leverage, there is a more general consensus regarding the role of short-term funding. López-Espinosa et al. (2012) find that short-term wholesale funding risk was underestimated prior to the financial crisis. Craig and Dinger (2013) find a positive link between wholesale market conditions and bank risk which they theoretically justify by the moral hazard view. Their findings suggest that increasing bank competition increases banks' incentives to invest in risky projects due to higher funding costs. Dewally and Yingying (2014) examine the impact of the liquidity shock in the wholesale funding market on the supply of bank credit during the peak of the financial crisis. They find that the dry-up in liquidity reduced lending relatively more in case of banks which relied more heavily on wholesale funding. Ivashina and Scharfstein (2010) find that banks which had better access to deposit funding or were less reliant on short-term debt, respectively, cut less lending activity after the collapse of Lehman Brothers.

5.4.3 Bank Lending

Banks, as financial intermediaries, provide liquidity and credit to firms and households. They screen credit risks and extend loans to financially constrained borrowers (DeAngelo and Stulz, 2013). They are especially important when the collateral value of assets is low and specific collection skills are important (Diamond and Rajan, 2000).

The marginal costs of banks' refinancing increase in debt. At the same time, banks have to require higher lending rates for relatively risky projects. Hence, an increase in banks' debt facilitates the access to capital for relatively risky projects (*adverse selection* problem). Moreover, the banks have more capital which can be used for lending to projects which otherwise would not be financed. Alternatively, we could argue that the marginal revenues of loans have to equal their marginal costs. Finally, this approach is in line with what Acharya et al. (2012) describe as lending "down the quality curve".

Modigliani and Miller (1958) show that the cut-off point for investment is completely unaffected by the type of security used to finance the investment. Translating this into maturity transformation means that from a theoretical perspective bank lending is unaffected by the maturity composition of bank liabilities.

5.5 Data

5.5.1 Dafne Databank

The Dafne databank, provided by the Bureau van Dijk, includes data on balance sheets, profit and loss accounts and the legal form for German firms. Although some of the data is available as early as 1999, coverage is limited and therefore only the three years period before the financial crisis, 2005 to 2007 is used. These three years are characterized by a sound economic environment and no significant regulatory changes. In total, the amount of firms varies between $15,000$ and $20,000$. This

accounts for approximately 42,000 observations from 2005 to 2007. To obtain a measure for corporate lending costs, we define an implicit lending rate associated with interest payments on bank loans using the reported balance sheet data. However, it is necessary to keep in mind that the data is not detailed enough to calculate bank or loan specific implicit lending rates. Thus, only an average implicit lending rate that firm i pays in period t on its entire bank debt can be calculated. Specifically, for each firm i in period t we calculate the implicit lending rate as

$$ILR_{it} = \frac{I_{it}}{L_{it}}, \tag{5.1}$$

where I_{it} denotes the total interest payments of firm $i = 1, ..., N$ in period t and L_{it} are total bank loans reported by firm i in period t. The implicit lending rate is employed in order to proxy the risk of the financed project. ILR_{it} does not only include interest payments but also comprises fees, commissions, penalties for late payment, expensive trade credit, and other costs associated with bank loans. Since the implicit lending rate, ILR_{it}, may be subject to errors due to e.g. new loans, loan repayment, and received interest payments. We exclude outliers and errors defined by an implicit rate above 30% lower than 0%, which corresponds approximately to the lowest and top 5 percent of its distribution. Implicit lending rates for firms are for example used by Benito and Whitley (2003) or Fidrmuc and Hainz (2013). On average an ILR of 8.73% is obtained. The 25th and 75th percentile equal 5.12% and 10.73%, respectively. The distribution of the ILR is similar to the distribution of interest rates used in previous studies. For example, Harhoff and Körting (1998a) use data originating from a survey of small and medium-sized German firms and obtain interest rates on average, where mean equals 9.2%, 25th percentile equals 7.5%, and 75th percentile equals 10.5%, which is almost equal to the implicit lending rates calculated here. Using data from the National Survey of Small Business Finances, in which trade credit constitutes a considerable fraction, Petersen and Rajan (1994) report interest rates of 11.3% on average with standard deviation of 2.2%. In addition to the im-

plicit lending rate, the profit margin, the EBIT margin, and cashflow/turnover are employed. Finally, we employ capital rentability in order to proxy financing demand by firms. Table 5.1 illustrates summary statistics of firm specific variables.

Finally, sectoral classification (Nace, Rev. 2) is available for each firm. This classification is organized with increasing granularity from sections, divisions and groups to classes. We take sections and classes into account to match each firm with an industry. We exclude financial intermediaries from our estimations.

5.5.2 Bankscope Databank

For each firm we draw data of all respective bank relations from Bankscope. First, the debt ratio of bank b in period t (DR_{bt}) is defined as 1 minus equity ratio (ER_{bt}),

$$DR_{bt} = 1 - ER_{bt} = 1 - \frac{E_{bt}}{TA_{bt}}, \tag{5.2}$$

where equity ratio equals equity (E_{bt}) divided by total assets (TA_{bt}). Second, to obtain the short-term funding ratio of bank b in period t (ST_{bt}) the balance sheet item "other deposits and short-term borrowings" ($ODSTB_{bt}$) is divided by total assets,

$$ST_{bt} = \frac{ODSTB_{bt}}{TA_{bt}}. \tag{5.3}$$

In total, relevant bank relations comprise up to 900 different bank units or branches which are identified according to the bank routing code. They account for $2,669$ observations from 2005 to 2007.

Table 5.1 illustrates both bank funding measures and firm-specific variables from 2005 to 2007. Both bank funding measures are relatively constant across the years. Similarly, firm-specific variables remain relatively unchanged across the years considered.

Table 5.1: Descriptive Statistics

			Mean	Std. Dev.	Min	Max
Bank	2005	Debt Ratio	0.941	0.018	0.835	0.998
		ST Funding Ratio	0.002	0.010	0.000	0.136
	2006	Debt Ratio	0.938	0.018	0.829	0.996
		ST Funding Ratio	0.002	0.010	0.000	0.153
	2007	Debt Ratio	0.937	0.019	0.813	0.988
		ST Funding Ratio	0.002	0.011	0.000	0.148
2005-2007		Debt Ratio	0.939	0.018	0.813	0.998
		ST Funding Ratio	0.002	0.010	0.000	0.153
Firm	2005	ILR	8.841	5.508	0.002	29.997
		EBIT	6.440	10.060	-59.270	60.000
		Profit	3.988	8.197	-58.800	59.790
		Cashflow	8.053	9.610	-58.800	59.970
		Capital Rentability	13.964	15.203	-16.970	55.980
	2006	ILR	8.649	5.425	0.007	29.939
		EBIT	6.703	10.278	-59.870	59.910
		Profit	4.470	8.500	-59.750	59.660
		Cashflow	8.431	10.069	-56.080	59.990
		Capital Rentability	15.727	15.534	-16.970	55.980
	2007	ILR	8.712	5.538	0.010	29.995
		EBIT	7.105	10.644	-58.490	59.740
		Profit	4.763	8.736	-58.430	59.850
		Cashflow	8.930	10.445	-55.120	60.000
		Capital Rentability	14.585	15.190	-16.990	55.990
2005-2007		ILR	8.734	5.487	0.002	29.997
		EBIT	6.700	10.289	-59.870	60.000
		Profit	4.355	8.450	-59.750	59.850
		Cashflow	8.408	9.995	-58.800	60.000
		Capital Rentability	14.789	15.341	-16.990	55.990

Source: Bankscope; Dafne.

Table 5.2 presents pairwise correlation coefficients for all variables specific to firm i that runs a bank relation with bank b in period t. As expected, proxies for firms' collateral (profit margin, EBIT margin and cashflow/turnover) are positively correlated and each of them is negatively correlated with the implicit lending rate. As expected, banks' short-term funding ratio and debt ratio are positively correlated with firms' implicit lending rate. Thus, we have initial weak evidence that bank funding is associated with the riskiness of funded projects. Both bank funding measures are positively correlated, since short-term funding contributes to bank debt. Higher capital rentability ought to be positively associated with the implied lending rate, which is reflected by the positive and significant correlation coefficient.

Table 5.2: Correlation Analysis

		Bank		Firm				
		Debt Ratio	ST Funding Ratio	ILR	Profit	EBIT	Cashflow	Capital Rentability
Bank	Debt Ratio	1.000						
	ST Funding Ratio	0.487*	1.000					
Firm	ILR	0.022*	0.035*	1.000				
	Profit	0.030*	0.044*	-0.054*	1.000			
	EBIT	0.024*	0.021*	-0.140*	0.683*	1.000		
	Cashflow	0.030*	0.017*	-0.203*	0.498*	0.620*	1.000	
	Capital Rentability	-0.014*	0.004*	0.093*	0.244*	0.061*	-0.018*	1.000

Note: * denotes significance at the 5%-level.

5.6 Estimation and Results

5.6.1 Estimation

Our approach relies on the models developed by Diamond and Rajan (2000) and Holmstrom and Tirole (1997) where banks first tap capital markets before granting loans to projects. Thus, higher bank debt makes relatively riskier projects more likely to be financed, hence, we expect that the corporate lending rate depends positively on the bank debt ratio. In line with Harhoff and Körting (1998a), collateral and lending rate conditions are determined sequentially, in a way that the lending rate setting follows the collateral decision. Higher collateral by firms facilitates access to bank loans.

We estimate the impact of banks' debt ratio and short-term funding ratio on implicit lending rates,

$$ILR_{ibt} = \beta_0 + \beta_1 DR_{ibt} + \beta_2 ST_{ibt} + \beta_3 C_{ibt} + \beta_4 R_{ibt} + \psi_i + \theta_t + u_{ibt}. \tag{5.4}$$

Variables are specific to firm i and bank b. Our dependent variable, ILR_{ibt}, firms' implicit lending rate is employed to capture the riskiness of firms' projects financed by banks. DR_{ibt} represents banks' debt ratio and ST_{ibt} represents banks' short-term funding ratio. To account for the important role of collateral regarding loan decisions (Diamond and Rajan, 2000; Holmstrom and Tirole, 1997; Bester, 1985; Stiglitz and Weiss, 1981), C_{ibt} represents a proxy for collateral. R_{ibt} measures firms' capital rentability and ought to control for the financing demand of risky projects. ψ_i reflects firm size dummies including quartile 1 to 3, θ_t stands for time fixed effects, and u_{ibt} denotes the residual.

A specific feature of our data set is that observations are nested. Four dimensions are specified in order to apply a multilevel model (Kayo and Kimura, 2011): sectors (Nace, Rev. 2), s, regions (federal states), r, banks, b, and firms, i. In such a multilevel

model, the clusters themselves are nested in superclusters, forming a hierarchical structure. It is known that business conditions and infrastructure differ for specific industries with respect to the federal state where they are located. In addition, competition in the German banking market differs across regions. The residual, u_{ibt}, is decomposed into random effects and an error term,

$$u_{ibt} = u_{srbit} = \lambda_{srbi} + \lambda_{rbi} + \lambda_{bi} + \lambda_i + \varepsilon_{srbit}, \tag{5.5}$$

where λ_{srbi} is the random intercept for sector s, region r, bank b, and firm i, λ_{rbi} is the random intercept for region r, bank b, and firm i, λ_{bi} bank b and firm i, and λ_i is the random intercept for firm i. The random effect for a sector, region, and bank is nested within firms, in the sense that it does not take on the same value for a given combination of sector, region, and bank across all firms, but takes on different values for each combination of all dimensions. The between-firm heterogeneity is modeled by the firm-level random intercept.

Coefficient β_1 reflects a change in bank debt relative to total assets, keeping the short-term funding ratio, firm's collateral, firm's capital rentability and firm size constant. We hypothesize that banks with higher debt ratios will grant riskier loans. Thus, bank debt is positively associated with the riskiness of financed projects. Correspondingly, we expect β_1 to be positive. It is noteworthy that a one unit change in debt ratio by far exceeds a change of one percentage point in debt, since debt ratio equals debt standardized by total assets. Coefficient β_2 reflects a change in a bank's liability composition. With respect to the short-term funding ratio, there are opposing arguments in the previous literature (see e.g. Modigliani and Miller, 1958; Dewally and Yingying, 2014; Craig and Dinger, 2013; López-Espinosa et al., 2012; Ivashina and Scharfstein, 2010). However, including ST_{ibt} allows to control for the maturity composition of banks' liabilities. The coefficient for the collateral proxy is hypothesized to decrease the implicit lending rate, correspondingly β_3 is expected to be negative. Higher collateral reduces monitoring costs and in turn the

risk premium. Collateral is proxied by profit margin, the EBIT margin, and cash-flow/turnover, which are comparable across industries. Firms' capital rentability is hypothesized to be positively associated with firms' project risk. The Firm size dummies are employed in order to control for firm heterogeneity.

5.6.2 Baseline Regressions

We start our empirical analysis with the estimation of equation (5.4) for all firms available, excluding financial intermediaries. We include sectoral random effects specified at the class-level (about 450 classes). Table 5.3 presents estimation results. The coefficient of the debt ratio enters the regressions positively and statistically significantly at a 1%-level. Also, its size is similar for all three different proxies for collateral (column I to III). Hence, the estimated coefficient of the debt ratio confirms our hypothesis that more indebted banks allocate more capital to riskier projects.

We confirm the hypothesis that the maturity composition of funding is important to the allotment of capital to risky projects. Moreover, the coefficients for the short-term funding ratio are significant for all proxies of collateral at the 5%-level. In turn, these results are in line with the recent empirical literature arguing that short-term funding matters with respect to lending. As expected, all proxies for collateral significantly reduce the implicit lending rate. A higher capital rentability is associated with a higher project risk. The coefficients of the firm size dummies are not reported in Table 5.3 but show that smaller firms face lower implicit lending rates.

Table 5.3: Bank Funding, Basic Specification, 2005 - 2007

	(I)	(II)	(III)
Random Effects	region, sector (class), bank, firm	region, sector (class), bank, firm	region, sector (class), bank, firm
Fixed Effects	time	time	time
Collateral [*Firm*]	profit margin	cashflow/turnover	ebit margin
Size Dummies [*Firm*]	yes	yes	yes
Debt Ratio	5.230***	5.455***	5.246***
[*Bank*]	(1.886)	(1.888)	(1.889)
ST Funding Ratio	3.561**	3.401**	3.658**
[*Bank*]	(1.646)	(1.647)	(1.648)
Collateral	-0.011***	-0.058***	-0.025***
[*Firm*]	(0.004)	(0.004)	(0.004)
Capital Rentability	0.015***	0.018***	0.016***
[*Firm*]	(0.002)	(0.002)	(0.002)
Constant	4.392**	4.536**	4.461**
	(1.790)	(1.792)	(1.794)
No of obs	41863	41587	41798
LRL	-126,309	-125,468	-126,214

Notes:
(1) * (**) [***] denotes significance at the 10% (5%) [1%] level.
(2) Standard errors are reported in parentheses.
(3) *LRL* - Log restricted-likelihood.
(4) Label in brackets distinguishes between firm and bank specific variables.

Next, we compare firms which are engaged in relationship banking (Rajan, 1992) and arm's length banking. The former are identified as firms which have only one bank relation, the latter are the firms with more than one bank relation. Table 5.4 shows that financing conditions of firms engaged in relationship banking are not affected by banks' financing in Germany. This may correspond to specific characteristics of banks and firms engaged in relationship banking. On the other hand, the results of firms with multiple bank relations are similar to those obtained for the whole sample. However, the short-term funding ratio is only marginally significant if profit margin and cash flow to turnover ratio are used as a proxy for collateral.

Table 5.4: Bank Funding, 2005 - 2007, Relationship vs. Arm's Length Banking

Relationship Banking	(I)	(II)	(III)
Random Effects	region, sector (class), bank, firm	region, sector (class), bank, firm	region, sector (class), bank, firm
Fixed effects	time	time	time
Collateral [*Firm*]	profit margin	cashflow/turnover	ebit margin
Size Dummies [*Firm*]	yes	yes	yes
Debt Ratio	5.770	6.601	6.588
[*Bank*]	(4.978)	(5.017)	(4.988)
ST Funding Ratio	2.230	3.438	2.261
[*Bank*]	(4.188)	(4.219)	(4.193)
Collateral	-0.014*	-0.050***	-0.029***
[*Firm*]	(0.007)	(0.007)	(0.007)
Capital Rentability	0.016***	0.016***	0.017***
[*Firm*]	(0.004)	(0.004)	(0.004)
Constant	3.492	3.158	2.896
	(4.714)	(4.752)	(4.723)
No of obs	6151	6061	6088
LRL	-18,683	-18,452	-18,536

Arm's Length Banking	(I)	(II)	(III)
Random Effects	region, sector (class), bank, firm	region, sector (class), bank, firm	region, sector (class), bank, firm
Fixed effects	time	time	time
Collateral [*Firm*]	profit margin	cashflow/turnover	ebit margin
Size Dummies [*Firm*]	yes	yes	yes
Debt Ratio	4.577**	4.836**	4.179**
[*Bank*]	(2.021)	(2.017)	(1.745)
ST Funding Ratio	3.231*	3.126*	3.764**
[*Bank*]	(1.780)	(1.774)	(1.559)
Collateral	-0.011**	-0.067***	-0.038***
[*Firm*]	(0.004)	(0.004)	(0.004)
Capital Rentability	0.016***	0.021***	0.018***
[*Firm*]	(0.002)	(0.002)	(0.002)
Constant	5.072***	5.197***	5.433***
	(1.918)	(1.913)	(1.656)
No of obs	35712	35526	35710
LRL	-107,588	-106,954	-109,686

Notes:
(1) * (**) [***] denotes significance at the 10% (5%) [1%] level.
(2) Standard errors are reported in parentheses.
(3) *LRL* - Log restricted-likelihood.
(4) Label in brackets distinguishes between firm and bank specific variables.
(5) Relationship banking and arm's length banking are identified as one and multiple bank relationships, respectively.

5.6.3 Industry Specific Regressions

In order to analyze the effect of deleveraging on an industry level, we run industry-specific regressions specified, again by equation (5.4).[2] Thereby, industries are defined at section level according to the Nace Classification (Rev. 2). Because this analysis requires a sufficiently large number of observations at the section level, only sections of about 500 observations are taken into consideration. This reduces our sample of 19 different sections to 12 sections[3]. Similarly to the baseline analysis, three different proxies for collateral and firm size dummies are used.

For a given industry, a strong impact of the banks' debt ratio on the implicit lending rate implies that the industry is highly sensitive to bank deleveraging. Such industry would experience deteriorating access to loans if regulatory changes cause banks to delever, since firms facing a high implicit lending rate run riskier projects and represent the worst credit assets (Hyun and Rhee, 2011) in banks' balance sheets. Furthermore, we look at sectors with the highest impact of collateral variables because tighter financing conditions are likely to influence sectors where collateralization is important.

Table 5.5 reports the results of the industry specific regressions. Since results are not sensitive to the use of different proxies for collateral, only outcomes employing the EBIT margin as a proxy for collateral are reported.[4] Manufacturing (C), wholesale and retail trade (G) and human health and social work activities (Q) are identified as the industries which are most dependent on banks' debt ratio. However, the coefficient for manufacturing is significant at the 1%-level, whereas it is only weakly significant for wholesale and health. In addition, the collateral variable is also highly

[2]Likewise, this analysis is repeated multiple times with one particular industry excluded each time, in order to identify the most influential industries. The results are available upon request from authors.

[3]**A** – Agriculture (Agriculture, forestry and fishing), **C** – Manufacturing, **D** – Electricity (Electricity, gas, steam and air conditioning supply), **E** – Water (Water supply; sewerage, waste management and remediation activities), **F** – Construction, **G** – Wholesale (Wholesale and retail trade; repair of motor vehicles and motorcycles), **H** – Transportation (Transportation and storage), **J** – Information (Information and communication), **L** – Real Estate (Real estate activities), **M** – Professional (Professional, scientific and technical activities), **N** – Administration (Administrative and support service activities), and **Q** – Health (Human health and social work activities).

[4]Results for the remaining regressions are available upon request.

significant for manufacturing. On the contrary, for almost all other industries, excluding construction, real estate and professional, the effect of the collateral variables on the implicit lending rate is insignificant.

Table 5.5: Bank Funding, Basic Specification, 2005 - 2007, Industry Specific Regressions

	Agri-culture	Manu-facturing	Elec-tricity	Water	Con-struction	Whole-sale
Debt Ratio	-15.327	10.291***	2.651	6.512	-2.340	6.267*
[*Bank*]	(10.204)	(3.647)	(8.771)	(11.235)	(6.593)	(3.788)
ST Funding Ratio	31.088***	-2.375	6.486	9.744	4.263	-0.341
[*Bank*]	(10.734)	(3.045)	(7.436)	(9.746)	(5.641)	(3.457)
Ebit Margin	-0.027	-0.041***	-0.007	0.003	-0.058***	-0.031**
[*Firm*]	(0.024)	(0.011)	(0.018)	(0.018)	(0.016)	(0.014)
Capital Rentability	0.042***	0.010***	-0.020*	0.006	0.012**	0.012***
[*Firm*]	(0.013)	(0.004)	(0.012)	(0.011)	(0.006)	(0.004)
Constant	22.583**	0.524	6.411	1.686	12.830**	4.283
	(9.634)	(3.462)	(8.316)	(10.654)	(6.236)	(3.587)
No of obs	772	12011	1554	931	4423	10465
LRL	-2,164	-36,700	-4,338	-2,564	-13,800	-32,100

	Transpor-tation	Infor-mation	Real Easte	Profe-ssional	Admin-istration	Health
Debt Ratio	-12.546	-21.402	5.991	17.229	7.876	14.101*
[*Bank*]	(8.369)	(15.842)	(5.189)	(11.488)	(10.064)	(7.719)
ST Funding Ratio	3.763	17.147	9.757	-4.454	6.651	21.121**
[*Bank*]	(7.161)	(13.620)	(4.403)	(9.831)	(7.987)	(8.237)
Ebit Margin	-0.013	0.023	-0.009**	-0.063***	-0.011	0.028
[*Firm*]	(0.011)	(0.028)	(0.004)	(0.022)	(0.010)	(0.018)
Capital Rentability	-0.004	-0.008	0.045***	0.050***	0.014	-0.007
[*Firm*]	(0.007)	(0.016)	(0.006)	(0.011)	(0.009)	(0.009)
Constant	19.982**	29.486**	0.336	-7.483	1.268	-7.280
	(7.949)	(15.037)	(4.921)	(10.882)	(9.522)	(7.345)
No of obs	1782	662	3466	1267	1532	1794
LRL	-5,191	-2,088	-9,090	-3,971	-4,671	-4,910

Notes:
(1) * (**) [***] denotes significance at the 10% (5%) [1%] level.
(2) Standard errors are reported in parentheses.
(3) *LRL* - Log restricted-likelihood.
(4) Label in brackets distinguishes between firm and bank specific variables.
(5) All specifications include random effects for region, sector (class), bank, and firm as well as fixed effects time and firm size dummies.

Banks' debt ratio has a strong effect on the implicit lending rate that is highly significant for manufacturing. This suggests that the access to loans for firms in manufacturing depends more on banks' ability to lever, compared to other industries. A possible explanation could be, for example, that on average firms in manufacturing have higher capital expenditures than firms in other industries. In Germany, the majority of capital expenditure is assigned to the manufacturing industry. Investment in these long term assets is mostly financed by bank loans. Therefore, deleveraging strongly affects the manufacturing sector.

The characteristics of firms in manufacturing (C), wholesale and retail trade (G) and human health and social work activities (Q) are illustrated in Table 5.6. Manufacturing reveals the expected characteristics: the implicit lending rate is, on average, statistically higher compared to the remaining sections. Excluding profit margin, firms in manufacturing face statistically lower collateral proxies on average. Capital rentability exceeds on average those of the remaining sectors. In addition, firms in manufacturing have, on average, more bank relations. The share of firms with only one bank relation is 8 percentage points lower for manufacturing if compared with the remaining sectors. Finally, firms from the manufacturing section operate with larger banks. The mean of the total assets of banks which operate with manufacturing firms is statistically higher than the mean of the total assets of banks operating with all other sectors. Thus, we identify manufacturing as the sector to suffer most from a regulatory change causing bank deleveraging, which sums up to a consistent overall picture. Wholesale and retail trade share some characteristics of manufacturing, whereas human health and social work activities represent a specific case.

Table 5.6: Characteristics of manufacturing (section C), wholesale and retail trade; repair of motor vehicles and motorcycles (section G) and human health and social work activities (section Q)

Year	Mean	All sections	Manufacturing	Wholesale	Health
2005	ILR	8.841	9.767	9.381	6.154
	t-statistic		(-13.741)	(-7.777)	(13.113)
	Ebit Margin	6.440	4.964	3.265	2.816
	t-statistic		(10.423)	(22.618)	(9.142)
	Profit Margin	3.988	4.152	2.491	1.783
	t-statistic		(-1.412)	(12.927)	(6.817)
	Cashflow/Turnover	8.053	6.181	3.499	7.925
	t-statistic		(13.884)	(34.662)	(0.339)
	Capital Rentability	13.964	16.285	16.186	7.171
	t-statistic		(-12.461)	(-11.613)	(12.002)
2006	ILR	8.649	9.510	9.299	5.815
	t-statistic		(-13.898)	(-9.942)	(15.626)
	Ebit Margin	6.703	5.168	3.386	3.397
	t-statistic		(10.325)	(22.052)	(8.590)
	Profit Margin	4.470	4.380	2.685	2.343
	t-statistic		(0.862)	(14.329)	(6.752)
	Cashflow/Turnover	8.431	6.348	3.505	7.978
	t-statistic		(14.535)	(34.304)	(1.234)
	Capital Rentability	15.727	18.133	17.998	7.955
	t-statistic		(-13.450)	(-12.003)	(14.983)
2007	ILR	8.712	9.818	9.330	5.926
	t-statistic		(-15.353)	(-7.761)	(14.647)
	Ebit Margin	7.105	5.595	3.285	2.907
	t-statistic		(8.156)	(19.512)	(9.970)
	Profit Margin	4.763	4.926	2.601	2.474
	t-statistic		(-1.018)	(13.267)	(6.612)
	Cashflow/Turnover	8.930	6.349	3.474	7.724
	t-statistic		(14.097)	(28.835)	(2.854)
	Capital Rentability	14.585	17.806	15.933	7.919
	t-statistic		(-16.445)	(-6.272)	(12.709)

Notes: The t-test shows whether the mean of the reported section is equal to the mean of the remaining sections. t-statistics are reported in parentheses.

5.7 Conclusion

We discuss the relationship between bank funding and corporate lending in Germany. This topic has received much importance in the recent economic policy discussion, because banks will have to comply with a comprehensive set of reforms including tighter capital requirements. As bank financing is the main source of finance in Germany, the new regulations may have a strong impact on its economy.

Using a unique dataset for banks and their corporate lenders in Germany between 2005 and 2007, we analyze the transmission of bank funding to corporate lending in Germany. We show that the financial leverage of banks determines the corporate sector's access to financing. We find that a reduction in bank debt might differently translate into the allocation of capital to specific industries.

In order to identify industries which are expected to face tighter access to bank loans if banks have to delever, we analyze sector-specific multilevel regressions. Thereby, firms involved in manufacturing and to a lesser degree in wholesale and retail trade are found to be particularly vulnerable to changes in banks' debt. The extent of the transmission of bank funding to corporate loans for manufacturing firms is the main finding of this study. The analysis reveals that the access to loans for firms in manufacturing depends heavily on the debt ratio of their bank relations. At the same time, the lending conditions in manufacturing are already strongly determined by the available collateral. Firms in manufacturing face on average a higher implicit lending rate, have lower collateral, are less engaged in relationship banking, and operate with larger banks.

Furthermore, our results show that the lending conditions in industries that are significantly determined by banks' debt ratio depend also most significantly on the collateral value. Therefore, the possibility for these firms to react to potential bank deleveraging by providing more collateral is rather limited.

Chapter 6

Intangible Assets and Determinants of Relationship Banking of German SMEs

6.1 Abstract and Details of the Article

6.1.1 Abstract

We focus on the determinants and potentially associated benefits of relationship banking. Based on the existing literature and the unique role intangible assets play regarding firms' capital structure, we test two hypotheses using rich data on firm-bank relationships in Germany. We show that firstly, a high share of intangible assets does not worsen the access of firms to external finance. And secondly, firms' share of intangible assets statistically significantly determines firms' choice of an exclusive and persistent bank relation.

JEL Classifications: G21, G32, D82, C21.

6.1.2 Details of the Article

This article is joint work with Jarko Fidrmuc and Philipp Schreiber.[1] I presented it at the following conference:

- Asian Finance Association (AsianFA) 2015 Conference, Changsha/ China, July 2015.

Since August 2015, an earlier version of this article is published in FEN (Financial Economics Network) Asian Finance Association (AsianFA) 2015 Conference, Vol. 1 No. 4, 08/17/2015.

6.2 Introduction

Germany represents an example of a bank-based financial system (Allen and Gale, 1995b) characterized by strong ties between banks and firms. The German economy is shaped by a strong role of small and medium enterprises (SMEs) which are mainly financed through bank loans, making firm-bank relationships very important in Germany. Furthermore, SMEs cannot easily substitute bank loans with corporate debt during a credit crunch (Giesecke et al., 2012). In addition, one very specific characteristic of the German banking system is the existence of long-term bank relationships that firms engage in with specific banks, referred to as "house banks". A house bank acts as the main lender of a firm and acquires more relevant and more timely information about it.

Recent work by Cecchetti and Kharroubi (2015) provides robust empirical evidence that financial sector growth is a drag on real growth. Regarding the mechanism behind this finding, Cecchetti and Kharroubi (2015) introduce the assumption that growth in finance reflects improving technology for recovering debt in cases of default. Their theoretical model implies that financial sector growth disproportionally

[1]We would like to thank Marcel Tyrell, Mark Mietzner, Dirk Schiereck and conference participants for helpful comments and discussions.

benefits sectors with output or assets that are more tangible. Confronting their theoretical model with the data, Cecchetti and Kharroubi (2015) find that financial sector growth benefits industries with higher asset tangibility, but harms R&D-intensive industries. This distributional effect of financial sector growth harms what economists consider engines of growth - namely, industries with lower asset tangibility or high R&D-activities (Cecchetti and Kharroubi, 2015).

Compared with arm's-length lending, there are two distortions due to relationship banking (Rajan, 1992) emphasized in the literature. Firstly, relationship lending causes poor price signals which can distort the allocation of funds. Hoshi et al. (1990) find that investments of firms with strong bank ties are less sensitive to their operating cash flow. Peek and Rosengren (1998) find that Japanese banks reallocated profitable funds into declining markets, due to strong relations with borrowers. Secondly, relationship lending reduces the liquidity of financial assets (Diamond and Rajan, 2001). In addition, a more bank-based system has a comparative disadvantage in financing intangible assets (Rajan and Zingales, 2001; Hoshi et al., 1991).

However, Germany's economy, characterized by a bank-based financial system, strong ties between banks and firms and a high share of small and medium enterprises, delivered a stable performance during the years of crises and attracted international attention. German banks with strong ties to their clients actually fo finance intangible assets, as we will show during the remainder of this paper. Therefore, the specific characteristics of relationship banking in the German financial system warrant more detailed inspection.

Our paper contributes to a broad literature. Theoretical contributions emphasize the benefits of reduced asymmetric information but also the costs of an information monopoly by banks (Boot, 2000). Results of empirical studies regarding financing conditions associated with relationship banking are mixed (Kysucky and Norden, 2014). Studies devoted to financing conditions were followed by studies focusing on firms' choice of the number of bank relations (see e.g. Farinha and Santos, 2002;

Ogawa et al., 2007). However, we should keep in mind that the question of how many bank relations a firm chooses is inherently different from the question of why a firms chooses a single instead of multiple bank relations. In the following, we will focus only on the second question.

In particular, we discuss the relationship between intangible assets, capital structure and relationship banking for German SMEs. To the best of our knowledge, the relationship between intangible assets and relationship banking has not yet been analyzed in the previous literature. Yet, intangible assets represent an increasingly important phenomenon (Cecchetti and Kharroubi, 2015). Using a large dataset for German SMEs and their bank relations between 2005 and 2012, we test two hypotheses. Firstly, do intangible assets worsen firms' access to external finance, as capital structure literature predicts? Following the rejection of this hypothesis, we test, secondly, whether firms with a high fraction of intangible assets are more likely to engage in relationship banking?

The centerpiece of our contribution is the question of why firms decide to have a single bank relation. Based on the results of testing the first hypothesis, we employ intangible assets as an explanatory variable in a binary regression in order to identify the determinants of relationship banking. The share of intangible assets ought to increase the probability of a strong firm-bank relation due to the firm's need to use the associated soft information channel in order to reduce financing frictions. We find that the share of intangible assets significantly increases the probability of an exclusive and persistent bank relation.

6.3 Literature Review

6.3.1 Theoretical Considerations

The seminal contribution of Diamond (1984) illustrates that a bank is the optimal channel for funds from investors to firms given costly information asymmetries

between both parties. This so-called delegated monitoring model implies that firms operate with a single bank which pools the costs of asymmetric information (Diamond, 1984). By having only one lender the firm minimizes its transaction costs. The optimality of a single bank relation changes when repeated lending is considered (Sharpe, 1990). Other theoretical reasons for choosing more than one bank relation are e.g. diversification as insurance against the loss of value-relevant information (Detragiache et al., 2000) or the lack of coordination among investors (see e.g. Bolton and Scharfstein, 1996; Hart, 1995; Dewatripont and Maskin, 1995). However, it is widely observed that many firms have multiple bank relations, whereas other very similar firms prefer a strong firm-bank relation.

The theoretical literature comes to the conclusion that there are two sides to a strong firm-bank relation (Boot, 2000). On the one hand, a strong firm-bank relationship can be beneficial, as information asymmetry is reduced and loan terms better reflect the actual quality of the borrower. On the other hand, the lender can use this information monopoly to extract additional rents. Therefore, a strong relationship can produce a hold-up problem.

6.3.1.1 Information Asymmetry

The idea of an advantage in the firm-bank relationship arising from the resolved information asymmetry goes back to Boot and Thakor (1994) and Petersen and Rajan (1995).

Boot and Thakor (1994) consider a model with an infinitely repeated bank-borrower relationship. Thereby, they assume risk-neutrality and the absence of learning and find that nonetheless, the firm profits from a durable bank relation in the following sense: a bank charges higher interest rates and demands collateral for loans that go to firms which are not established yet. If the bank observes a positive outcome, e.g. a project success, the firm becomes established and is awarded with unsecured loans and lower interest rates. Therefore, the bank acquires information about the

firm by engaging in costly monitoring. However, both, the firm and the bank profit from the close firm-bank relation.

Petersen and Rajan (1995) show that in a two-period model with *good* and *bad* entrepreneurs banks also have an incentive to charge high interest rates initially and improve financing conditions for good entrepreneurs subsequently. The idea is similar to Boot and Thakor (1994) in the sense that information asymmetry about the quality of the entrepreneurs exists at the beginning and is resolved in later periods.

Taken together, both studies support the idea that a close firm-bank relationship is advantageous for firms and banks if asymmetric information exists.

6.3.1.2 Hold-up Problem

The hold-up problem describes the concept that borrowing from a single bank can be costly for the firm. If a close bank-firm relationship reduces information asymmetry and if the firm cannot credibly transfer information to other parties, the bank can use this information advantage to extract additional rents (see e.g. Farinha and Santos, 2002; Sharpe, 1990; Greenbaum et al., 1989). The bank, with which the firm is in a close relationship has an information monopoly and becomes sort of an insider regarding information about the firms creditworthiness. In a world without information asymmetry, a close firm-bank relation would not produce a the hold-up problem, since the firm could easily convey information to other lenders. Therefore, the problem should be more pronounced if information asymmetry is high, i.e. if the difference between information of insiders vs. outsiders increases. One possible solution of the hold-up problem is to establish multiple bank relations and therefore reduce the rents that arise due to the hold-up situation (Thadden, 1995).

6.3.2 Empirical Evidence

To assess costs and benefits of a strong firm-bank relation empirically, one has to proxy for the strength of the relation. Kysucky and Norden (2014) conduct a meta

analysis of the relationship banking literature and show that the most prominent proxies are the length of the firm-bank relation, the exclusivity of the relation (e.g. the number of banks the firm lends from), physical distance and the integration of the firm-bank relation (e.g. the number of financial services the firm obtains).

Empirical results are mixed. Petersen and Rajan (1994) were the first to empirically study the relation between different dimensions of the strength of lending relationships with the availability and cost of funds. In a sample of US SMEs, collected from the National Survey of Small Business Finance (NSSBF), they find that firms borrowing from multiple lenders are charged significantly higher rates. The length and integration of the relationship does not affect price conditions. However, the availability of credit increases if firms spend more time in a relationship, if they increase the number of financial services they obtain in a relationship and if they concentrate their borrowing to a single or only a few lenders. In addition, Berger and Udell (1995) also use the NSSBF sample and focus their analysis on floating-rate lines of credit. They provide evidence that the length of the firm-bank relationship is negatively related to loan prices and to the probability that the lender will require collateral to secure the loan. In contrast, using a more recent NSSBF dataset, Cole (1998) finds that only the existence of a previous relationship, but not its length, is an important factor for credit availability.

Harhoff and Körting (1998b) study a large sample of German SMEs. They proxy for the strength of the firm-bank relationship using the duration of the lending relationship, the number of financial institutions the firm is actually borrowing from, and a subjective indicator of trust. They find that neither the duration nor the number of financial institutions influences the costs of credit. However, collateral requirements improve with the strength of the relationship, as measured by both of these proxies.

Elsas and Krahnen (1998) follow a different approach. They study factors that determine whether a firm engages in relationship banking. To proxy for relationship banking, a written statement of the firm about whether or not a bank has house bank

status is used. They show that factors related to the information access of banks are important determinants. However, the duration of the bank-borrower relationship is not related to house bank status. They empirically show that house banks provide liquidity insurance in case of unexpected deteriorations of borrower ratings. Mayer et al. (1988) describe this insurance as banks using monopoly power in good times to charge above-market rates and in exchange therefore providing insurance by means of below-market rates in bad times. However, in a study investigating the determinants of the existence of house banks, Elsas (2005) finds that house bank relationships become more likely as competition increases. This contradicts the conjecture that relationship banking requires monopolistic market structures and encourages research addressing firms' choice of bank relations.

Degryse and Ongena (2005) study the effect of geographical distance on bank loan rates. Using a unique data set of loans made to SMEs and single-person businesses by a Belgium bank, they show that loan rates improve with the distance between the firm and the bank and deteriorate with the distance between the firm and competing banks. In a similar vein, Petersen and Rajan (1995) find that in more concentrated markets relationship lending is more likely and that relatively more credit is available to young firms. This finding is reflected in below-market rates for young firms and, conversely, above-market rates for more mature firms.

Schenone (2010) compares firms' interest rates before and after a large information shock (IPO) which exogenously levels the playing field among banks and, thus, erodes the relationship bank's information monopoly. Schenone (2010) finds that firms' interest rates prior to the IPO are a U-shaped function of relationship intensity but change to a decreasing function of relationship intensity after the IPO. The U-shaped pattern of interest rates is rationalized by information asymmetries between relationship banks and outside banks.

6.3.3 Number of Bank Relations

Early studies of relationship banking (see e.g. Petersen and Rajan, 1994; Harhoff and Körting, 1998b; Cole, 1998) use the number of bank relationships as a proxy for competition among banks. The investigation of banks' choice of the number of relations then followed these initial contributions related to relationship banking.

Ongena and Smith (2000) investigate the determinants of multiple-bank relationships in a cross-country study including 1079 firms from 20 European countries. Their measure of the number of bank relationships relies on firms' reported number of banks they use for cash management purposes, which includes short-term lending, within their own country. They find that firms have more bank relationships in countries with a decentralized and healthy banking system, in countries with inefficient judicial systems, and in countries where the enforcement of creditors' rights is weak. Similarly to Houston and James (1996), Ongena and Smith (2000) find that firms with multiple bank relations tend to be larger.

In order to identify the advantages of close banking relationships, Houston and James (2001) focus on bank financing of publicly traded firms in the United States. They find that firms' size, leverage and market-to-book ratio decreases the likelihood of having a single bank relationship. Market-to-book ratio is employed to proxy firms' growth potential, meaning that their results indicate that firms with considerable growth options are less likely to be financed by a single bank. Houston and James (2001) explain this finding by banks' lending being focused on so-called hard assets and their corresponding inability to fund firms with substantial amounts of intangible growth opportunities.

Farinha and Santos (2002) focus on firms' decisions to replace a single bank relation with several relationships and employ data of young small Portuguese firms between 1980 and 1996. They show that the likelihood of firms substituting a single bank relation in favor of several bank relation increases with the duration of its

initial single bank relation. Furthermore, Farinha and Santos (2002) show that this substitution happens more frequently with firms which that have more growth opportunities or perform poorly, respectively. The first finding is explained by a lemon premium, increasing over time, which firms face when approaching an additional lender. The second finding is explained by banks limiting their exposure to poor credit, which causes poor performing firms to approach an additional lender.

Ogawa et al. (2007) analyze the choice of the number of long-term banking relations of large listed Japanese firms between 1982 and 1999. In particular, they study why firms have additional bank relations besides their main bank and the optimal number of creditors for a firm given the existence of a main lender. It is noteworthy that their data include a period of deregulation in Japan and, most importantly, the period of stagnation in the aftermath of the collapse of Japan's economy in 1990, characterized by banks burdened with a huge amount of non-performing loans. However, they present a binomial logit regression to address the question of why firms choose a single or multiple loans. Hence, their question and approach is closely related to our analysis. Ogawa et al. (2007) find that a higher indebtedness decreases the probability of a single loan relation and liquidity increases it. Firm size and profitability do not have a systematic impact. In a multinomial logit regression they find that the determinants of the amount of bank relations conditional on having more than one bank relation are different the determinants of the choice of a single bank relation.

6.4 Hypotheses

Relationship banking received considerable attention throughout the literature. However, we intend to be less agnostic regarding the decision of engaging in only one bank relation.

Motivated by Hall and Lerner (2010), who argue that intangible assets[2] and knowledge created by innovation are difficult to quantify as collateral for debt financing, we emphasize the role of a firm's share of intangible assets when deciding on borrowing relations. It is worth noting that research and development as well as a highly skilled workforce are among the main determinants of the creation of intangible assets.

Even though they are in themselves conflicting theories, both the trade-off theory of capital structure (Modigliani and Miller, 1963) and the pecking order theory (Myers and Majluf, 1984) imply difficulties to debt-finance intangible assets. The trade-off theory of capital structure describes a firm's debt-equity decision as a trade-off between an interest tax shield and the costs of financial distress, where intangible assets ought to rely primarily on equity financing (Brealey et al., 2008). The pecking order theory implies that management prefers the issuance of debt over equity, but this does not apply to intangible assets for which equity is the preferable way of financing (Brealey et al., 2008).

Benmelech and Bergman (2009) construct a measure of asset redeployability as a proxy of the value of collateral to creditors in case of default. Higher asset redeployability increases the liquidation value of the collateral. They show that asset redeployability is negatively related to credit spreads, and positively related to credit ratings as well as loan-to-value ratios in an economically significant manner. In addition, Fabbri and Menichini (2010) find that firms' financing decisions depend in multiple ways on the collateral value of their inputs, such that for example trade credit for sufficiently liquid inputs purchased on account is not subject to credit rationing. Distinguishing between current assets and intangible assets, the former are understood to be relatively liquid and easier to redeploy than the latter.

[2] Across the literature, definitions of intangible assets are manifold (see for example Ahonen (2000), Petty (2000), and Sveiby (1997)) and even from the perspective of financial reporting according to IFRS-3, valuing acquired as well as self-generated intangible assets is still seen as a black art due to the enormous difficulties and risks associated with measurement (Sharma, 2012).

Thus, taking into account the capital structure literature and the role of asset redeployability, we hypothesize that a higher share of intangible assets ought to be associated with more equity-financing.

Hypothesis 1. *A higher fraction of intangible assets leads to a higher equity ratio.*

In order to bring these considerations into connection with relationship banking, we look at the way that, as previously noted, relationship banking provides a channel for soft information. To achieve optimal financing conditions, channeling soft information is more beneficial to firms with a higher share of intangible assets. Moreover, conditionally conservative accounting systems (Gör and Wagenhofer, 2009) may theoretically give rise to the need of channeling soft information.

Thus, if achieving optimal financing conditions is a reason to engage in relationship banking and intangible assets represent by their nature a source of financing frictions, the causal chain we propose becomes clear. To the best of our knowledge, a causal relationship between intangible assets and relationship banking has not been studied in the literature yet.[3]

Hypothesis 2. *Firms with a high fraction of intangible assets are more likely to engage in relationship banking.*

Hence, our contribution focuses on firms' financing conditions and the corresponding borrowing relations; it thus emphasizes firms' decisions to engage in relationship banking.

6.5 Data and Descriptive Statistics

Our data come from the Amadeus databank provided by the Bureau van Dijk. The dataset includes information on balance sheets, profit and loss accounts, the legal form, and the industrial code (Nace, Rev. 2) for German firms. The coverage

[3]In addition, high quality firms, which are highly innovative and invest a lot in R&D activities, might prefer a single lender, since they are not willing to share their knowledge with multiple lenders (Yosha, 1995). As noted, research and development contributes to the creation of intangible assets.

of firms is relatively good for data from the period of 2005 to 2012. We limit our analysis to non-listed German firms of limited liability without floating debt between 2005 and 2012, for which we have at least 6 consecutive observations. Hence, firms in our sample have debt and equity on their balance sheets, with the debt part being composed of bank loans only.

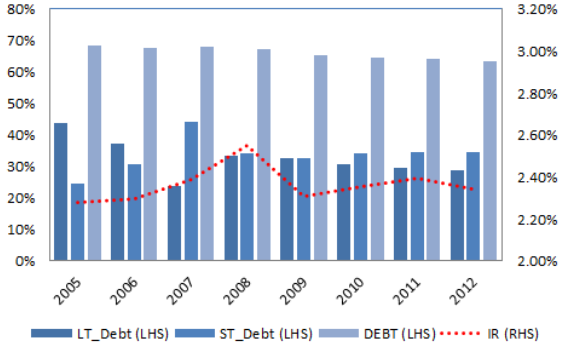
In addition to information on balance sheets and profit and loss accounts, the Amadeus databank provides the amount of bank relations firms had between 2005 and 2012. However, the information about the number of bank accounts is aggregated in the following way: for each firm the number of different bank accounts within the time period from 2005 to 2012 is given.[4] Thus, this information is not time-varying and we therefore limit our analysis to the cross section. After dropping observations subject to logical errors, missing data, and outliers at the firm level, the time-invariant nature of the variable for bank relations requires us to aggregate all variables over years by calculating their arithmetic means, which reduces our sample to a cross-section including roughly 22,000 observations.

By collapsing our data into the cross-section, the variable *number of banks* satisfies two out of four prominent proxies for relationship banking (Kysucky and Norden, 2014). First, the length of the firm-bank relation, which has to be at least six years. Second, the exclusivity of the relationship. If the amount of bank relations equals one, we know that the corresponding firm operated solely with the same bank over six years. This has the advantage that we can identify firms which operated with only one bank between 2005 and 2012. In addition, we are able to distinguish between the main players in the German banking market. For all firms that have only one bank relation, we can distinguish between relations with Deutsche Bank, Commerzbank, Cooperative Banks (Genossenschaftsbanken), and Saving Banks (Sparkassen).

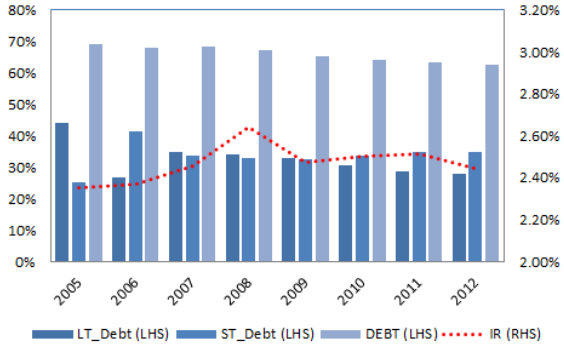
[4] Assume for example a firm with bank accounts at bank A and B for the period from 2005 to 2008. If this firm terminates both accounts in 2009 and opens a new account at bank C from 2009 to 2012, the number of banks for this firm would equal three.

Figure 6.1a to Figure 6.1f present the share of long- (LT_Debt) and short-term debt (ST_Debt) as well as financing costs (IR) depending on the number of bank relations. Interest rates are defined as interest expenses divided by debt. And as already emphasized, debt corresponds to bank loans. Both the total share and the development over time seem to be independent of the number of bank relations. Firms shifted their financing from more long-term to more short-term debt between 2005 and 2012. However, it can be observed that, on average, firms with only one bank relation pay lower interest rates than firms with more than one bank relation. Figure 6.1g shows the distribution of bank relations. The majority of observations lies between one and three bank relations and about one quarter of firms have a single bank relation. According to the Bureau van Dijk, information regarding the number of banks is collected from the firms' annual report and capped at six. Therefore, firms in the last category can have six or more bank relations. In the empirical analysis, we will mainly distinguish between one and more than one bank relations. Figure 6.1h shows that one third of all firms having a single bank relation are served by Saving Banks, followed by Commerzbank (17%), Cooperative Banks (12%), and Deutsche Bank (11%). One quarter of firms with a single bank relation are financed by "non-main players" in the German banking market.

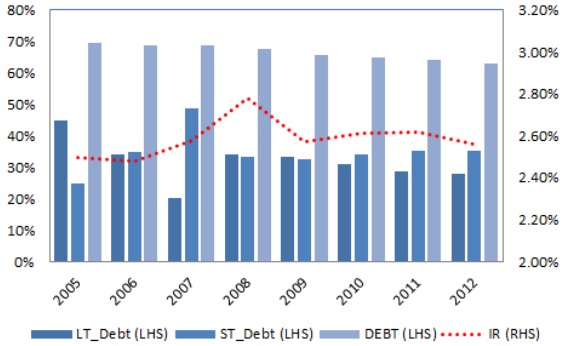
Figure 6.1: Stylized Facts



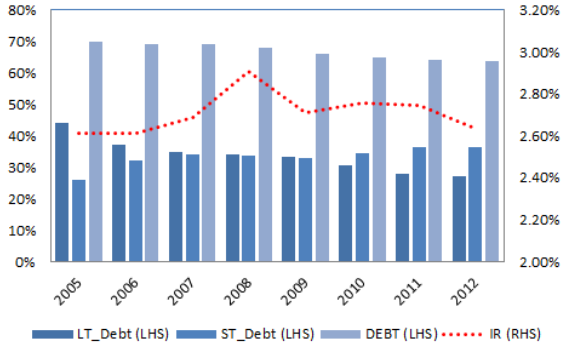
(a) One Bank Relation



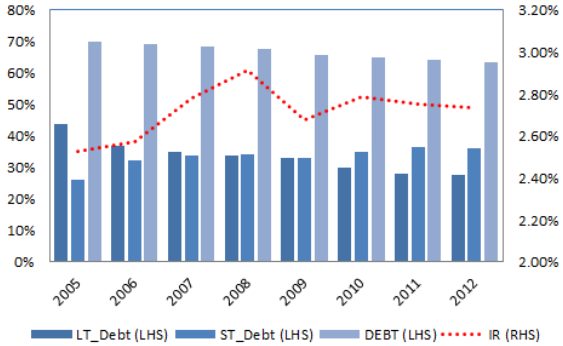
(b) Two Bank Relations



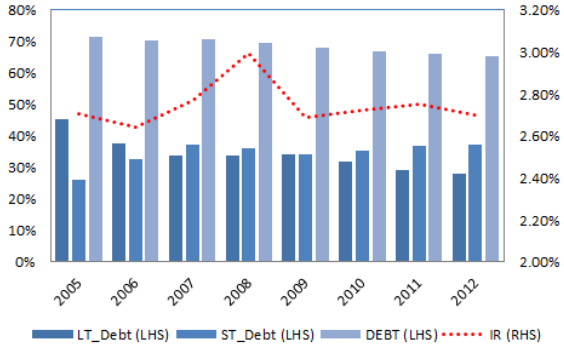
(c) Three Bank Relations



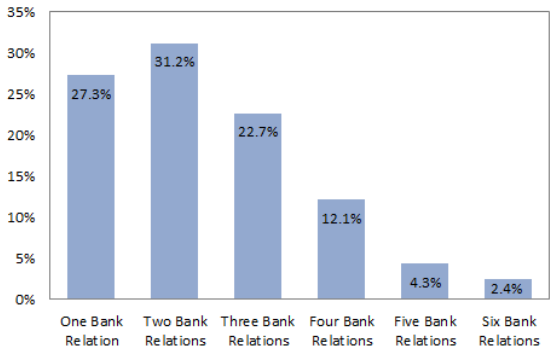
(d) Four Bank Relations



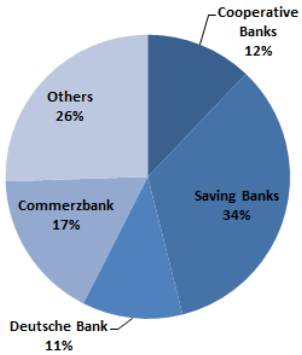
(e) Five Bank Relations



(f) Six or more Bank Relations



(g) Bank Relations



(h) Relationship Lending

In Table 6.1, firms with only one bank relation are compared to all other firms. Surprisingly, firms with only one bank relation are, on average, larger than other firms (as measured by total assets). Most importantly, we find the most pronounced difference in the shares of intangible and current assets. Firms with only one bank relation have a higher share of intangible assets and a lower share of current assets on average, which is in line with our hypothesis.

Table 6.1: Bank Characteristics

	Mean	>1 Bank Relation	1 Bank Relation
Size	Sales	83,214	94,162
			(-1.138)
	Employees	286	281
			(0.141)
	Total Assets	55,631	78,022
			(-2.791)
Balance Sheet Items (in keur)	Equity/Total Assets	0.335	0.339
			(-1.159)
	ST_Debt/Total Assets	0.330	0.327
			(0.952)
	LT_Debt/Total Assets	0.335	0.334
			(0.243)
	ST_Debt/LT_Debt	1.892	2.569
			(-4.508)
	Debt/Total Assets	0.665	0.661
			(1.158)
	Intangible Assets/Total Assets	0.012	0.019
			(-10.118)
	Current Assets/Total Assets	0.656	0.596
			(15.303)
P&L	Cashflow	3,798	4,221
			(-0.563)
	EBIDTA	5,664	7,038
			(-2.034)
	Interest Rate	0.026	0.024
			(9.567)

Notes: The t-statistic is reported in parentheses and; highlighting in red indicates statistical significance at the 5% level. Null hypothesis is diff=0 where diff equals mean(0)-mean(1) and 1 represents the specific section.

6.6 Estimation and Results

6.6.1 Capital Structure

Both the trade-off theory of capital structure and the pecking order theory imply that intangible assets impair debt-financing. Thus, firms whose share of intangible assets is above one of the thresholds used here ought to have higher equity ratios.

To address this question, we apply propensity score matching as introduced by Rosenbaum and Rubin (1983) and Rosenbaum and Rubin (1985) and implemented by Leuven and Sianesi (2003). We define three treatment groups, which each comprise firms whose share of intangible assets (IA) exceeds zero, the sample median ($\approx$0.03%) or the sample mean ($\approx$1.44%), respectively. Firms whose share of intangible assets is above one of these thresholds ought to face higher equity ratios, according to the capital structure literature and the role of asset redeployability. Since the share of intangible assets is not assigned completely at random to firms, the probability of receiving treatment, $D = 0 \vee 1$, will be estimated conditional on the following confounders: sales; employees; tangible assets (standardized by total assets); current assets (standardized by total assets); long-term debt (standardized by total assets); short-term debt (standardized by total assets); cash flow; EBITDA; net income; industry dummies; and main economic regions dummies. The outcome variable, EQ, is firms' equity ratio, which equals equity divided by total assets. The estimated "Average Treatment Effect on the Treated" (ATT) is

$$ATT = E[EQ(1)|D = 1] - E[EQ(0)|D = 0] + SB, \tag{6.1}$$

where $E[EQ(1)|D = 1]$ is the expected outcome given treatment, $E[EQ(0)|D = 0]$ is the expected outcome in the absence of treatment, and SB is the selection bias.

In an unmatched comparison, the equity ratio of firms whose share of intangible assets is above one of the specified thresholds is statistically significantly higher. However, if we employ equity ratio as the outcome variable Y according to equation (6.1), Table 6.2 shows that the differences in equity ratios disappear comparing matched firms. This suggests that there is another way than equity to finance intangible assets, which we expect to be relationship banking.

We estimate equation (6.1) in various permutations. The treatment is varied in that it refers to the share of intangible assets exceeding either the sample mean or the median or zero. The matching algorithm is varied between the nearest neighbor, the two nearest neighbors, the three nearest neighbors or a normally distributed kernel using a range of 0.06. Covering all possible combinations, we run twelve propensity score matching estimations.

Table 6.2: Propensity Score Matching - Results - Intangible Assets and Capital Structure

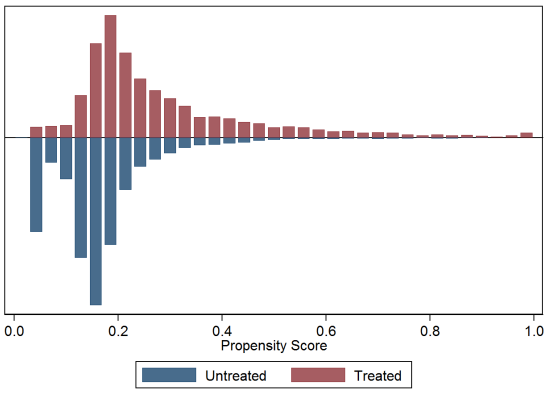
Treatment	IA > Mean					IA > Mean				
Matching	Nearest Neighbor					2 Nearest Neighbors				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.344	0.335	0.009	0.004	2.290	0.344	0.335	0.009	0.004	2.290
ATT	0.344	0.343	0.001	0.006	0.090	0.344	0.344	0.000	0.005	0.020
pseudo R-squared			0.104					0.104		
Number of Obs			17004					17004		
Treatment	IA > Mean					IA > Mean				
Matching	3 Nearest Neighbors					Kernel				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.344	0.335	0.009	0.004	2.290	0.344	0.335	0.009	0.004	2.290
ATT	0.344	0.345	-0.001	0.005	-0.270	0.344	0.343	0.001	0.006	0.090
pseudo R-squared			0.104					0.104		
Number of Obs			17004					17004		
Treatment	IA > Median					IA > Median				
Matching	Nearest Neighbor					2 Nearest Neighbors				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.350	0.323	0.027	0.003	8.810	0.350	0.323	0.027	0.003	8.810
ATT	0.350	0.356	-0.006	0.005	-1.220	0.350	0.354	-0.004	0.005	-0.970
pseudo R-squared			0.112					0.112		
Number of Obs			17004					17004		
Treatment	IA > Median					IA > Median				
Matching	3 Nearest Neighbors					Kernel				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.350	0.323	0.027	0.003	8.810	0.350	0.323	0.027	0.003	8.810
ATT	0.350	0.354	-0.004	0.004	-0.900	0.350	0.356	-0.006	0.005	-1.220
pseudo R-squared			0.112					0.112		
Number of Obs			17004					17004		
Treatment	IA > 0					IA > 0				
Matching	Nearest Neighbor					2 Nearest Neighbors				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.341	0.289	0.052	0.005	9.620	0.341	0.289	0.052	0.005	9.620
ATT	0.341	0.351	-0.010	0.013	-0.730	0.341	0.341	0.001	0.012	0.050
pseudo R-squared			0.141					0.141		
Number of Obs			17004					17004		
Treatment	IA > 0					IA > 0				
Matching	3 Nearest Neighbors					Kernel				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.341	0.289	0.052	0.005	9.620	0.341	0.289	0.052	0.005	9.620
ATT	0.341	0.345	-0.003	0.011	-0.280	0.341	0.351	-0.010	0.013	-0.730
pseudo R-squared			0.141					0.141		
Number of Obs			17004					17004		

The most important measures are difference and the corresponding t-statistics of the "Average Treatment Effect on the Treated" (ATT).

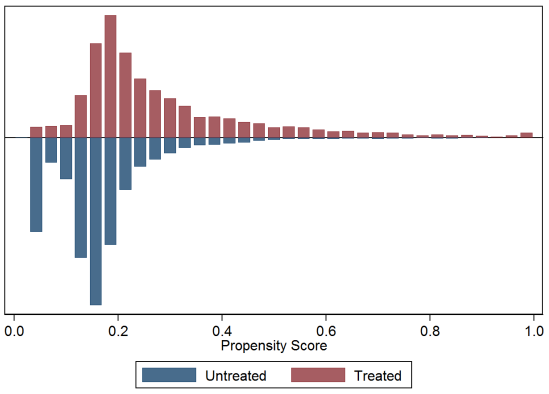
The low value of the pseudo R^2 reveals that average heterogeneity is low. For the main specifications, Figure 6.2 visualizes that observations are quite equally distributed along the propensity score, especially when the mean and median are used as thresholds. The technically high quality of our estimations supports the approach.

All in all, results show that intangible assets do not prevent German SMEs from financing externally. We expect that German SMEs can circumvent the financing frictions associated with intangible assets by a strong bank relation, referred to as relationship banking. This directly implies our second hypothesis, namely that a higher share of intangible assets increases the probability of having an exclusive and persistent bank relation.

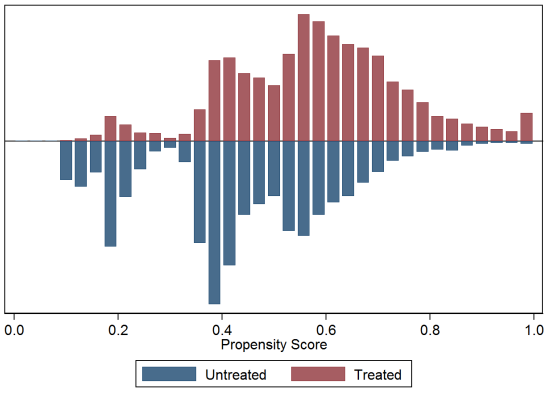
Figure 6.2: Propensity Score Matching - Quality - Intangible Assets and Capital Structure



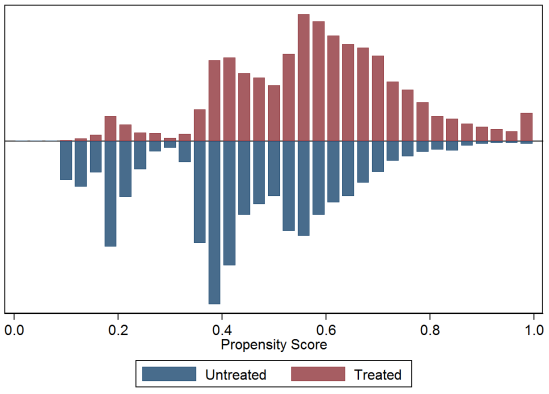
(a) Mean, nearest Neighbor.



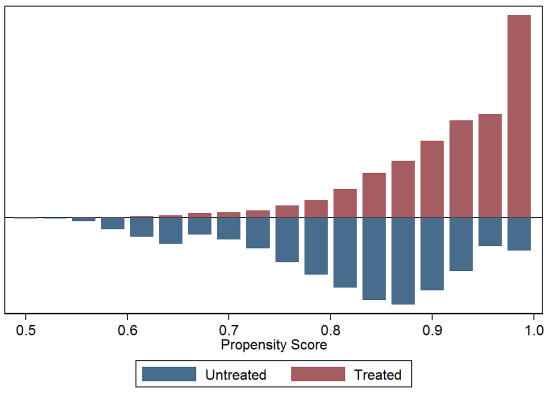
(b) Mean, Kernel.



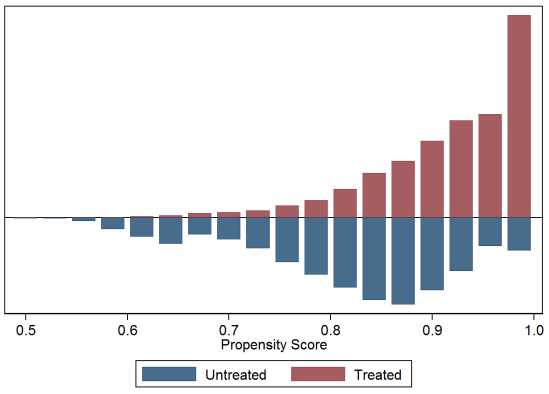
(c) Median, nearest Neighbor.



(d) Median, Kernel.



(e) Zero, nearest Neighbor.



(f) Zero, Kernel.

6.6.2 Determinants of Relationship Banking

Based on previous studies we combine the following variables in order to explain the choice of the number of bank relations: firm size, proxied by either sales or employees; redeployable collateral, proxied by current assets (as a share of total assets); financing frictions, proxied by intangible assets (as a share of total assets); indebtedness, proxied either by debt (as a share of total assets) or by the ratio of short term debt to long term debt; and liquidity/profitability, proxied by EBITDA. In order to assess whether a higher share of intangible assets determines firms' number of bank relations, we estimate the following baseline regression:

$$\begin{aligned} P(RB_i = 1) = & f(\beta_1\ SIZE_i + \beta_2\ CA_i + \beta_3\ IA_i \\ & + \beta_4\ DEBT_i + \beta_5\ EBITDA_i + X'\ \gamma + u_i) \end{aligned} \tag{6.2}$$

where RB equals 1 for firms with one bank relation and 0 otherwise. The matrix X includes further control variables: binary variables for industries at the section level according to the industrial code (Nace, Rev. 2) and a binary variable which equals 1 in case the firm is located in one of three main economic regions of Germany (Bavaria, Baden-Wuerttemberg, Nordrhein-Westfalen), where bank concentration can be expected to be higher than in other regions.

Firm size is expected to increase the number of bank relations (Houston and James, 1996; Ongena and Smith, 2000). As we argue along the lines of collateral redeployability (Benmelech and Bergman, 2009; Fabbri and Menichini, 2010), current assets are expected to increase the number of bank relations because the soft channel of a strong firm-bank relation is less needed. Indebteness is expected to increase the probability of having only one bank relation since a strong bank relation may help to ease credit constraints (Harhoff and Körting, 1998b). In the three main economic regions of Germany we expect relationship banking to be less likely, as suggested by to Petersen and Rajan (1995).

6.6.3 Logistic Regression - Results

Since our dependent variable in equation (6.2) is a count variable, which is discrete-valued and truncated, an OLS estimation produces biased results for both, slope coefficient and standard errors. Given the nature of our dependent variable, a probabilistic model is the most appropriate estimation method. Since the number of bank relations between 2005 and 2012 is reported across years, we know that if it equals 1 the corresponding firm had exactly one bank relation during the whole period.

Table 6.3 presents the results of four logistic regression specifications. Two different proxies for firm size and indebtedness were used. In specification I and II the number of employees proxy for size, whereas in specification III and IV total sales are used. Indebtedness is proxied by total debt divided by total assets (specification I and III) and by the fraction of short- to long-term debt (specification II and IV). Following *Hypothesis 2*, the null hypothesis states that the share of intangible assets does not affect the probability of running an exclusive and persistent bank relation. We can reject the null hypothesis on a 1% significance level. The fraction of intangible assets significantly increases the probability of having only one bank relation. Thereby, the odds ratio can be interpreted as the factor by which the odds of having only one bank relation increase[5]. The odds ratio for an explanatory variable i with an coefficient β_i is calculated as e^{β_i}. In our case, this means, that a 1 percentage point increase in the ratio of intangible assets ($\frac{1}{100}$unit increase) corresponds to an odds ratio of $e^{\frac{1}{100}\beta_i}$. For specification I, this results in an odds ratio of $e^{0.02314} = 1.0234$. Therefore, the odds of having only one bank relation increase by 2.34% per 1 percentage point increase in the fraction of intangible assets. Our results are robust to

[5]For example, if a firm has a 10% probability of having only one bank relation, the odds for this firm are $\frac{10\%}{90\%} = .11$. An odds ratio now gives the change in the odds of having only one bank relation, if an explanatory variable is increased by one unit. An odds ratio of 10.12, for example, translates to odds of having only one bank relation of $0.11 * 10.12 = 1.12$, resulting in a new probability of having one bank relation of 53%. The odds ratio can range from 0 to ∞ with an odds ratio of 1 implying no effect of the explanatory variable.

the use of different size and indebtedness proxies. In summary, we can confirm our second hypothesis.

Table 6.3: Logistic Regression - Determinants of Relationship Banking

	(I)		(II)		(III)		(IV)	
dependent variable	Relationship Banking 0/1		Relationship Banking 0/1		Relationship Banking 0/1		Relationship Banking 0/1	
	Coeff.	Odds Ratio	Coeff.	Odds Ratio	Coeff.	Odds Ratio	Coeff.	Odds Ratio
Employees	-0.009***	1.000	-0.008***	1.000				
	(0.003)		(0.003)					
Sales					0.000	1.000	0.000	1.000
					(0.000)		(0.000)	
Current Assets/Total Assets	-0.223***	0.800	-0.253***	0.776	-0.160*	0.852	-0.179**	0.836
	(0.076)		(0.077)		(0.084)		(0.085)	
Intangible Assets/Total Assets	2.314***	10.116	2.341***	10.389	2.371***	10.707	2.404***	11.069
	(0.354)		(0.354)		(0.369)		(0.369)	
Debt/Total Assets	0.269***	1.309			0.280***	1.323		
	(0.085)				(0.096)			
ST_Debt/LT_Debt			0.018***	1.018			0.015***	1.015
			(0.004)				(0.004)	
EBITDA	0.000***	1.000	0.000***	1.000	0.000	1.000	0.000	1.000
	(0.000)		(0.000)		(0.000)		(0.000)	
Constant	-0.469		-0.337		-0.508*		-0.368	
	(0.288)		(0.285)		(0.295)		(0.292)	
Industry Dummies	yes		yes		yes		yes	
Main Region Dummies	yes		yes		yes		yes	
No of obs	21517		21517		17166		17166	
Correctly Classified	73.10%		73.15%		71.60%		71.63%	
Area under ROC Curve	0.639		0.642		0.632		0.635	

Note:
(1) * (**) [***] denotes significance at the 10% (5%) [1%] level.
(2) Robust standard errors are reported in parentheses.
(3) Employees expressed in terms of 100.

In addition, size proxies are neither statistically significant (sales) nor economically meaningful (employees). Both proxies for indebtedness are significant and positive. Firms with a higher fraction of debt are more likely to have a single bank relation which is in line with Ogawa et al. (2007). One interpretation of this finding is that greater indebtedness is a signal, albeit not necessarily a reliable one, for low borrower quality to outside lenders. Therefore, firms are not able to establish a second bank relation, since they cannot convincingly communicate their true quality. Not reported but worth mentioning is the result that firms located in one of three main economic regions of Germany are less engaged in relationship banking, which is in line with Petersen and Rajan (1995).

Next, we estimate predicted probabilities and marginal effects of our logistic regression with an emphasis on variation in the share of intangible assets. Since more than 90% of firms have a share intangible assets between 0 and and 9%, we vary

the share of intangible assets in that range and estimate the corresponding predicted probabilities. The first row of Table 6.4 shows the predicted probability of an exclusive and persistent bank relation, given that all independent variables are set to their mean. Below, the predicted probability of an exclusive and persistent bank relation, given that all independent variables are set to their mean but the share of intangible assets equals zero is shown. The next rows show the predicted probability of an exclusive and persistent bank relation, given that all independent variables are set to their mean but the share of intangible assets equals 1%, 3%, etc.

Table 6.4 shows that margins continuously increase in the share of intangible assets. However, standard errors and in turn confidence intervals also increase in the share of intangible assets.

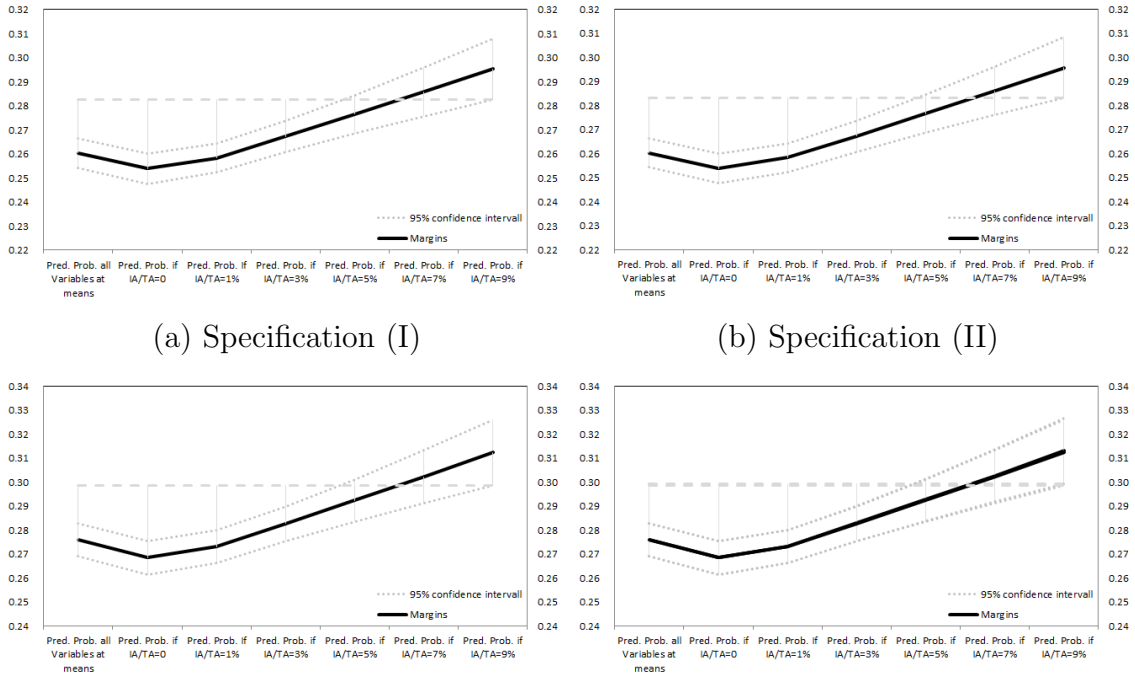
Table 6.4: Logistic Regression - Predicted Probabilities and Marginal Effects

	(I)	(II)	(III)	(IV)
dependent variable	Relationship Banking 0/1	Relationship Banking 0/1	Relationship Banking 0/1	Relationship Banking 0/1
Pred. Prob. all Variables at means	0.260***	0.260***	0.276***	0.276***
	(0.003)	(0.003)	(0.004)	(0.004)
Pred. Prob. if IA/TA=0	0.254***	0.254***	0.268***	0.269***
	(0.003)	(0.003)	(0.004)	(0.004)
Pred. Prob. if IA/TA=1%	0.258***	0.258***	0.273***	0.273***
	(0.003)	(0.003)	(0.004)	(0.004)
Pred. Prob. if IA/TA=3%	0.267***	0.267***	0.283***	0.283***
	(0.003)	(0.003)	(0.004)	(0.004)
Pred. Prob. if IA/TA=5%	0.276***	0.277***	0.292***	0.293***
	(0.004)	(0.004)	(0.004)	(0.004)
Pred. Prob. if IA/TA=7%	0.286***	0.286***	0.302***	0.303***
	(0.005)	(0.005)	(0.006)	(0.006)
Pred. Prob. if IA/TA=9%	0.295***	0.296***	0.312***	0.313***
	(0.006)	(0.006)	(0.007)	(0.007)

Note:
(1) * (**) [***] denotes significance at the 10% (5%) [1%] level.
(2) Robust standard errors are reported in parentheses.
(3) Roman numerals in the header refer to Table 6.3.

Figure 6.2 visualizes the margins and the corresponding confidence intervals. The lower end of the confidence interval of the predicted probability at a share of intangible assets of 9% remains in all cases untouched by the higher end of the confidence intervals of shares of intangible assets of 3% and below.

Figure 6.3: Predicted Probabilities and Marginal Effects



(a) Specification (I)

(b) Specification (II)

(c) Specification (III)

(d) Specification (IV)

6.7 Robustness

In order to provide robust results, we estimate equation (6.1) and equation (6.2) for selected sub-samples. Since we calculate averages over time and perform a cross-sectional analysis, we run equation (6.1) and equation (6.2) for 2006 and 2012 with the aim of illustrating whether our obtained results are stable over time.

Table 6.5 and Table 6.6 show that the equity ratio of firms whose share of intangible assets is above one of the specified thresholds is not statistically significantly higher, comparing matched firms. Thus, this relationship has not changed over time

Table 6.5: Propensity Score Matching - Results - Intangible Assets and Capital Structure - 2006

Treatment	IA > Mean					IA > Mean				
Matching	Nearest Neighbor					2 Nearest Neighbors				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.350	0.339	0.011	0.004	2.730	0.350	0.339	0.011	0.004	2.730
ATT	0.350	0.352	-0.002	0.006	-0.250	0.350	0.349	0.001	0.005	0.240
pseudo R-squared			0.099					0.099		
Number of Obs			15209					15209		
Treatment	IA > Mean					IA > Mean				
Matching	3 Nearest Neighbors					Kernel				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.350	0.339	0.011	0.004	2.730	0.350	0.339	0.011	0.004	2.730
ATT	0.350	0.351	-0.001	0.005	-0.160	0.350	0.352	-0.002	0.006	-0.250
pseudo R-squared			0.099					0.099		
Number of Obs			15209					15209		
Treatment	IA > Median					IA > Median				
Matching	Nearest Neighbor					2 Nearest Neighbors				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.354	0.328	0.026	0.003	7.870	0.354	0.328	0.026	0.003	7.870
ATT	0.354	0.362	-0.008	0.005	-1.450	0.354	0.359	-0.005	0.005	-1.140
pseudo R-squared			0.110					0.110		
Number of Obs			15209					15209		
Treatment	IA > Median					IA > Median				
Matching	3 Nearest Neighbors					Kernel				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.354	0.328	0.026	0.003	7.870	0.354	0.328	0.026	0.003	7.870
ATT	0.354	0.361	-0.007	0.005	-1.490	0.354	0.362	-0.008	0.005	-1.450
pseudo R-squared			0.110					0.110		
Number of Obs			15209					15209		
Treatment	IA > 0					IA > 0				
Matching	Nearest Neighbor					2 Nearest Neighbors				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.345	0.298	0.047	0.006	7.830	0.345	0.298	0.047	0.006	7.830
ATT	0.345	0.344	0.001	0.014	0.080	0.345	0.340	0.005	0.013	0.380
pseudo R-squared			0.134					0.134		
Number of Obs			15209					15209		
Treatment	IA > 0					IA > 0				
Matching	3 Nearest Neighbors					Kernel				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.345	0.298	0.047	0.006	7.830	0.345	0.298	0.047	0.006	7.830
ATT	0.345	0.345	0.000	0.012	-0.030	0.345	0.344	0.001	0.014	0.080
pseudo R-squared			0.134					0.134		
Number of Obs			15209					15209		

The most important measures are difference and the corresponding t-statistics of the "Average Treatment Effect on the Treated" (ATT).

in our sample. Again, treatment refers to the share of intangible assets exceeding the sample mean or median or zero and the matching algorithm is either the nearest neighbor, the two nearest neighbors, the three nearest neighbors or a normally distributed kernel using a range of 0.06.

Table 6.6: Propensity Score Matching - Results - Intangible Assets and Capital Structure - 2012

Treatment	IA > Mean					IA > Mean				
Matching	Nearest Neighbor					2 Nearest Neighbors				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.346	0.336	0.010	0.004	2.350	0.346	0.336	0.010	0.004	2.350
ATT	0.346	0.346	0.000	0.006	0.070	0.346	0.348	-0.002	0.005	-0.290
pseudo R-squared			0.104					0.104		
Number of Obs			15226					15226		
Treatment	IA > Mean					IA > Mean				
Matching	3 Nearest Neighbors					Kernel				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.346	0.336	0.010	0.004	2.350	0.346	0.336	0.010	0.004	2.350
ATT	0.346	0.350	-0.004	0.005	-0.810	0.346	0.346	0.000	0.006	0.070
pseudo R-squared			0.104					0.104		
Number of Obs			15226					15226		
Treatment	IA > Median					IA > Median				
Matching	Nearest Neighbor					2 Nearest Neighbors				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.353	0.323	0.029	0.003	8.970	0.353	0.323	0.029	0.003	8.970
ATT	0.353	0.354	-0.001	0.005	-0.250	0.353	0.356	-0.004	0.005	-0.790
pseudo R-squared			0.112					0.112		
Number of Obs			15226					15226		
Treatment	IA > Median					IA > Median				
Matching	3 Nearest Neighbors					Kernel				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.353	0.323	0.029	0.003	8.970	0.353	0.323	0.029	0.003	8.970
ATT	0.353	0.357	-0.005	0.004	-1.080	0.353	0.354	-0.001	0.005	-0.250
pseudo R-squared			0.112					0.112		
Number of Obs			15226					15226		
Treatment	IA > 0					IA > 0				
Matching	Nearest Neighbor					2 Nearest Neighbors				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.343	0.284	0.060	0.006	10.260	0.343	0.284	0.060	0.006	10.260
ATT	0.343	0.347	-0.003	0.014	-0.230	0.343	0.342	0.001	0.012	0.110
pseudo R-squared			0.140					0.140		
Number of Obs			15226					15226		
Treatment	IA > 0					IA > 0				
Matching	3 Nearest Neighbors					Kernel				
Model	Logit					Logit				
	Treated	Controls	Difference	S.E.	T-Statistic	Treated	Controls	Difference	S.E.	T-Statistic
Unmatched	0.343	0.284	0.060	0.006	10.260	0.343	0.284	0.060	0.006	10.260
ATT	0.343	0.344	-0.001	0.011	-0.050	0.343	0.347	-0.003	0.014	-0.230
pseudo R-squared			0.140					0.140		
Number of Obs			15226					15226		

The most important measures are difference and the corresponding t-statistics of the "Average Treatment Effect on the Treated" (ATT).

Results in Table 6.7 and Table 6.8 illustrate that the statistically significant relationship between the probability of having only one bank relation and the fraction of intangible assets does not change over time. In the beginning, as well as in the end of our sample period the fraction of intangible assets statistically significantly increases the probability of having only one bank relation.

Table 6.7: Logistic Regression - Determinants of Relationship Banking - 2006

	(I)		(II)		(III)		(IV)	
dependent variable	Relationship Banking 0/1		Relationship Banking 0/1		Relationship Banking 0/1		Relationship Banking 0/1	
	Coeff.	Odds Ratio	Coeff.	Odds Ratio	Coeff.	Odds Ratio	Coeff.	Odds Ratio
Employees	-0.008**	1.000	-0.008**	1.000				
	(0.004)		(0.004)					
Sales					0.000	1.000	0.000	1.000
					(0.000)		(0.000)	
Current Assets/Total Assets	-0.360***	0.697	-0.349***	0.705	-0.341***	0.711	-0.314***	0.730
	(0.095)		(0.095)		(0.096)		(0.095)	
Intangible Assets/Total Assets	2.561***	12.943	2.590***	13.326	2.192***	8.953	2.229***	9.289
	(0.404)		(0.403)		(0.390)		(0.390)	
Debt/Total Assets	0.284***	1.328			0.265**	1.304		
	(0.107)				(0.110)			
ST_Debt/LT_Debt			0.004*	1.004			0.002	1.002
			(0.002)				(0.001)	
EBITDA	0.000*	1.000	0.000*	1.000	0.000	1.000	0.000	1.000
	(0.000)		(0.000)		(0.000)		(0.000)	
Constant	-0.498		-0.356		-0.697**		-0.569*	
	(0.336)		(0.329		(0.346)		(0.341)	
Industry Dummies	yes		yes		yes		yes	
Main Region Dummies	yes		yes		yes		yes	
No of obs	13989		13989		12410		12409	
Correctly Classified	74.79%		74.85%		71.36%		71.43%	
Area under ROC Curve	0.6498		0.6518		0.6348		0.6352	

Note:
(1) * (**) [***] denotes significance at the 10% (5%) [1%] level.
(2) Robust standard errors are reported in parentheses.
(3) Employees expressed in terms of 100.

However, the significance of the coefficient of current assets divided by total assets and the size of the coefficient of intangible assets divided by total assets change from 2006 to 2012.

Table 6.8: Logistic Regression - Determinants of Relationship Banking - 2012

	(I)		(II)		(III)		(IV)	
dependent variable	Relationship Banking 0/1		Relationship Banking 0/1		Relationship Banking 0/1		Relationship Banking 0/1	
	Coeff.	Odds Ratio	Coeff.	Odds Ratio	Coeff.	Odds Ratio	Coeff.	Odds Ratio
Employees	-0.007**	1.000	-0.007**	1.000				
	(0.003)		(0.003)					
Sales					0.000	1.000	0.000	1.000
					(0.000)		(0.000)	
Current Assets/Total Assets	-0.052	0.949	-0.046	0.955	0.015	1.015	0.039	1.040
	(0.077)		(0.078)		(0.088)		(0.088)	
Intangible Assets/Total Assets	1.675***	5.341	1.725***	5.611	1.474***	4.367	1.534***	4.637
	(0.361)		(0.359)		(0.375)		(0.371)	
Debt/Total Assets	0.294***	1.342			0.345***	1.411		
	(0.080)				(0.096)			
ST_Debt/LT_Debt			0.003**	1.003			0.001	1.001
			(0.001)				(0.001)	
EBITDA	0.000**	1.000	0.000**	1.000	0.000	1.000	0.000	1.000
	(0.000)		(0.000)		(0.000)		(0.000)	
Constant	-0.615**		-0.474		-0.814**		-0.649**	
	(0.297)		(0.294)		(0.329)		(0.326)	
Industry Dummies	yes		yes		yes		yes	
Main Region Dummies	yes		yes		yes		yes	
No of obs	20166		20166		13853		13850	
Correctly Classified	73.65%		73.66%		70.74%		70.72%	
Area under ROC Curve	0.6333		0.6343		0.6234		0.6221	

Note:
(1) * (**) [***] denotes significance at the 10% (5%) [1%] level.
(2) Robust standard errors are reported in parentheses.
(3) Employees expressed in terms of 100.

Since we already emphasized the distribution of the fraction of intangible assets divided by total assets, we first exclude firms whose intangible assets equal zero. Thus, we focus rather on variation in intangible assets than on the question whether the firm owns intangible assets. Table 6.9 shows that also for this subsample the share of intangible assets increases significantly the probability of having only one bank relation.

Table 6.9: Logistic Regression - Determinants of Relationship Banking - IA/TA > 0

	(I)		(II)		(III)		(IV)	
dependent variable	Relationship Banking 0/1		Relationship Banking 0/1		Relationship Banking 0/1		Relationship Banking 0/1	
	Coeff.	Odds Ratio	Coeff.	Odds Ratio	Coeff.	Odds Ratio	Coeff.	Odds Ratio
Employees	-0.007***	1.000	-0.007***	1.000				
	(0.003)		(0.003)					
Sales					0.000	1.000	0.000	1.000
					(0.000)		(0.000)	
Current Assets/Total Assets	-0.139*	0.871	-0.166**	0.847	-0.066	0.936	-0.083	0.920
	(0.083)		(0.084)		(0.091)		(0.092)	
Intangible Assets/Total Assets	2.587***	13.295	2.604***	13.523	2.696***	14.818	2.720***	15.177
	(0.359)		(0.360)		(0.377)		(0.377)	
Debt/Total Assets	0.209**	1.233			0.237**	1.268		
	(0.090)				(0.102)			
ST_Debt/LT_Debt			0.016***	1.016			0.014***	1.014
			(0.004)				(0.004)	
EBITDA	0.000***	1.000	0.000***	1.000	0.000	1.000	0.000	1.000
	(0.000)		(0.000)		(0.000)		(0.000)	
Constant	-0.574*		-0.474		-0.627**		-0.512*	
	(0.298)		(0.294)		(0.306)		(0.302)	
Industry Dummies	yes		yes		yes		yes	
Main Region Dummies	yes		yes		yes		yes	
No of obs	19633		19633		15616		15616	
Correctly Classified	73.04%		73.10%		71.62%		71.60%	
Area under ROC Curve	0.6391		0.6411		0.6338		0.6355	

Note:
(1) * (**) [***] denotes significance at the 10% (5%) [1%] level.
(2) Robust standard errors are reported in parentheses.
(3) Employees expressed in terms of 100.

In addition to excluding firms without intangible assets, we exclude firms whose share of intangible assets is in the highest 1%-quantile. As before, the share of intangible assets increases significantly the probability of having only one bank relation (see Table 6.10 below). In sum, these analyses confirm the robustness of our results.

Table 6.10: Logistic Regression - Determinants of Relationship Banking - 0 < IA/TA < 99-quantile

	(I)		(II)		(III)		(IV)	
dependent variable	Relationship Banking 0/1		Relationship Banking 0/1		Relationship Banking 0/1		Relationship Banking 0/1	
	Coeff.	Odds Ratio	Coeff.	Odds Ratio	Coeff.	Odds Ratio	Coeff.	Odds Ratio
Employees	-0.007**	1.000	-0.007**	1.000				
	(0.003)		(0.003)					
Sales					0.000	1.000	0.000	1.000
					(0.000)		(0.000)	
Current Assets/Total Assets	-0.141*	0.869	-0.167**	0.846	-0.072	0.931	-0.088	0.916
	(0.083)		(0.084)		(0.092)		(0.093)	
Intangible Assets/Total Assets	3.582***	35.957	3.651***	38.523	3.502***	33.169	3.575***	35.682
	(0.653)		(0.652)		(0.690)		(0.689)	
Debt/Total Assets	0.220**	1.245			0.249**	1.283		
	(0.092)				(0.103)			
ST_Debt/LT_Debt			0.016***	1.016			0.014***	1.014
			(0.004)				(0.004)	
EBITDA	0.000***	1.000	0.000***	1.000	0.000	1.000	0.000	1.000
	(0.000)		(0.000)		(0.000)		(0.000)	
Constant	-0.589**		-0.485*		-0.641**		-0.521*	
	(0.298)		(0.295)		(0.306)		(0.302)	
Industry Dummies	yes		yes		yes		yes	
Main Region Dummies	yes		yes		yes		yes	
No of obs	19415		19415		15419		15419	
Correctly Classified	73.07%		73.08%		71.62%		71.62%	
Area under ROC Curve	0.6363		0.6383		0.6307		0.6323	

Note:
(1) * (**) [***] denotes significance at the 10% (5%) [1%] level.
(2) Robust standard errors are reported in parentheses.
(3) Employees expressed in terms of 100.

6.8 Conclusion

We discuss the relationship between intangible assets, capital structure and relationship banking for German SMEs. Separately, these topics have already received much attention in the academic literature. We thus contribute significantly by combining them and, in particular, by assigning a special role to the connection between intangible assets and firms' choice of bank relation.

Using a large dataset for German SMEs including their bank relations between 2005 and 2012, we test two hypotheses. Firstly, a higher fraction of intangible assets should lead to a higher equity ratio. We find that in a matched comparison there is no statistically significant difference in equity ratios among firms due to their share of intangible assets. We propose a strong firm-bank relation to help firms circumvent the financing frictions related to intangible assets emphasized in the literature. This naturally yields our next hypothesis. Secondly, we hypothesize that firms with a high fraction of intangible assets should be more likely to engage in relationship banking, since a close-firm bank relation helps overcome debt-financing problems.

We divide firms into three treatment groups separated by their share of intangible assets. A descriptive comparison reveals substantial differences in equity ratios. Given the existence of potential confounders, we estimate a propensity score matching model. Once, we are able to compare "treated" firms with the "controls", we find no statistically significant difference in equity ratios. If relationship banking helps firms with a higher share of intangible assets to receive bank loans, firms' borrower decision ought to be determined by their share of intangible assets.

Hence, the centerpiece of our contribution is to address the question of why firms decide to have only one bank relation. We have information regarding the number of bank relations of each firm, which is best employed in a binary fashion. Using this data, we indeed find that the share of intangible assets significantly increases the

probability of an exclusive and persistent bank relation. This result turns out to be robust with regard to the analysis of several sub-samples of our data.

Since our research is also motivated by Germany's stable performance during the global financial crisis and recent insights into the connection of financial sector growth and real growth (Cecchetti and Kharroubi, 2015), we show a possible, but marginal explanation for these observations.

Given data availability, future research should be extended to cross-country studies. The three-pillar structure of German the banking system is similar to banking systems in other European countries such as Austria, France, Italy, Spain and Sweden (Brunner et al., 2004). A cross-country analysis including those European countries is a natural extension of our analysis, which would allow to control for country-specific characteristics of relationship banking.

Chapter 7

Summary

This section provides a brief summary and policy recommendation with respect to European integration for each chapter; it concludes with an overall summary of the whole work.

7.1 Chapter 2 - OCA

Optimum currency area theory requires a sufficient degree of business cycle synchronization of the economies in a geographical region, in order for that region to constitute an optimum currency area. Even though the "convergence criteria", defined by the Maastricht treaty and the Stability and Growth Pact, miss a sound economic justification, they aim at providing the functioning of the euro area. The corresponding research question of this chapter is if the "convergence criteria" are linked to the theory of optimum currency areas by aligning demand shocks among euro area member states? Such a potential linkage is understood to be indirect given the lack of a sound economic foundation of the "convergence criteria".

This chapter finds that compliance with the "convergence criteria" plays a different role when applied solely to new member countries. In case of new member states, fiscal divergence is associated with bilateral demand shock divergence. This finding

can be explained by the lower political power new member countries have. However, it makes compliance with the "convergence criteria" for new member countries more important.

In addition to this result, this article contributes by taking the time dimension of the data explicitly into account. The existing literature often dilutes the time dimension by averaging over periods. In order to take the dimension of demand shocks into account, I use the modulus between two countries each period. This approach creates a panel of country-pairs.

7.1.1 Policy Recommendation based on Chapter 2

The results of this chapter imply that new member states of the euro area should enter the single currency with some fiscal capacity. However, such a recommendation is difficult to implement. New member states are naturally equipped with less political power. The overall results also imply that the bindingness of common rules has to be improved in order to make rules work. The European Fiscal Compact, which came into effect 2013, partly reflects this policy recommendation which is based on data until 2012.

7.2 Chapter 3 - Exchange Rate Policy in China

This chapter aims at identifying the secret currency basket used by the Chinese central bank managing the renminbi. In contrast to the majority of central banks in advanced economies, the People's Bank of China actively manages the Chinese exchange rate. This fact makes it possible to examine whether the euro is considered a reserve currency by the People's Bank of China. In other words, the question of what role the euro plays as an international currency can be addressed. In addition, this study is relevant for economists and policy makers in general, since it sheds some light upon secret currency weights used by the People's Bank of China. Moreover,

this study provides a better understanding of an economy which is expected to be the world's largest economy before 2030 according to the World Bank (2013).

We observe weak evidence that the euro was used as an exchange rate target at the beginning of 2010, but its weight approached zero after the deepening of the debt crisis in the euro area. Hence, even though the euro is often declared to be one of the major global currencies, it does not play significant role in Chinese exchange rate management. The US dollar remains the main anchor of Chinese exchange rate management, but the Thai baht gained some importance compared to earlier studies. Interestingly, a gradual decline of the weight attached to the US dollar coincides with major political and economic events in the Unites States. In this respect, the findings illustrate the importance of economic and political conditions for currencies.

This article also contributes methodologically by the application of the Kalman filter. The Kalman filter is appropriate for the estimation of the relationship between integrated variables and to represent gradual changes in the data. Non-differenced time series are assumed to be more informative regarding the changes of *de facto* exchange rate policy and the Kalman filter allows their use, which enables us to provide valuable insights into the actual Chinese exchange rate policy.

7.2.1 Policy Recommendation based on Chapter 3

The results of this chapter imply that the economic stability of an economy is vital in order for its currency to be treated as a global major currency. Economic stability is naturally one of the main goals in Europe after the deep recent crisis. Hence, this chapter indirectly provides further motivation of the other chapters in this work which aim at identifying measures to enhance economic growth and stability. European Safe Bonds could also enhance the euro's role as an international currency (Brunnermeier et al., 2011).

7.3 Chapter 4 - Institutions

There is a large body of literature on the connection of institutions and economic growth. However, most literature remains agnostic regarding the channels through which institutions may cause growth. Motivated by this puzzle in institutional economics, we analyze the relationship between institutional quality in terms of resolving insolvency and the efficient use of assets at firm-level. Thereby, we propose a narrow channel through which institutions potentially affect income per capita in the long-run.

Our benchmark for efficiency at the firm-level is provided by the interest coverage ratio, as firms should be able to serve at least their interest payments from their current earnings. Firms which fall below a specific threshold for one year or even longer are potentially wasting the entrepreneurs' resources and suffer from severe inefficiency, since they have to provide interest payments from internal sources. The existence of such firms is facilitated by institutional weaknesses.

The corresponding research question is whether more efficient institutions ensure a more efficient use of assets in the economy. Indeed, we find that more efficient institutions reduce the share of assets tied up unproductively in firms facing debt-servicing difficulties for more than one year. This result provides statistical evidence that very specific effect of institutional quality in terms of resolving insolvency. Based on descriptive statistics, we observe that institutional quality in terms of resolving insolvency is comparably weak in Central and Eastern European countries compared to mature economies like Germany, Austria, and Sweden.

By addressing a macroeconomic issue with the use of micro data, our approach contributes methodologically. A rich dataset at the firm-level allows us to aggregate data across sectors within countries and not rely on already aggregated data. Potential reverse causality problems are addressed by use or the dynamic panel system General Method of Moments estimator.

7.3.1 Policy Recommendation based on Chapter 4

Based on the empirical results a further catch-up in terms of institutional quality by central and eastern European countries is highly recommended. However, the implementation of institutional progress and, in particular, the enforcement of those changes are challenging due to considerable cultural differences. Hence, we recommend implementing laws gradually in order to allow social norms to adapt. Depending on the country specific level of institutional quality, relatively simple mechanisms like foreclosure with no or limited court oversight and floating charge can lead to immediate results.

7.4 Chapter 5 - Deleveraging

This chapter is motivated by the implementation of Basel III, which is an international regulatory framework. The possible effects that tighter capital requirements for banks might have on the economy are investigated for the case of Germany. Empirically addressing this issue aims at highlighting the potential country-specific effects of cross-country regulatory changes. Indeed, we find that such regulatory changes may transmit differently into different industries. Lending conditions especially for firms in manufacturing and to a lesser extent in wholesale and retail trade are expected to be affected most given tighter capital requirements for banks.

The casual chain behind these finding rely on the *adverse selection* problem, since an increase in banks' debt associated with higher refinancing costs facilitates the access to capital for relatively risky projects. This equivalent to banks whose marginal revenues of loans have to equal their marginal costs. In addition, this approach is in line with what Acharya et al. (2012) describe as lending "down the quality curve".

We make use of unique data on firm-bank relationships in Germany between 2005 and 2007 from two different databases. We utilize information on the bank relationships of analyzed firms, which allows us to merge individual firm level data with the

corresponding bank data. Moreover, our multilevel modeling approach utilizes the information given by the structure of the data set with respect to different criteria. In particular, we use fixed effects and random effects for sectors, regions, banks, and firms. Not only working with large micro-data but also incorporating the structure of the data is an efficient and valuable empirical approach.

7.4.1 Policy Recommendation based on Chapter 5

Results imply that country-specific banking characteristics must be taken into account when implementing cross-country regulation. In Germany, tighter capital requirements for banks could impair access to bank loans for manufacturing firms. In other European countries to which the same rules apply, other industries' access to bank loans might be impaired due to regulatory changes. Regulation should take this into account when applying uniform rules to banks across Europe.

7.5 Chapter 6 - Relationship Banking

As a bank-based financial system characterized by strong ties between banks and firms and a fairly strong performance during the global financial crisis, the banking system of Germany is worth studying. In addition, the creation of a European banking union makes it necessary to identify country-specific characteristics which have to be considered carefully when applying uniform rules to a wide range of countries. This study focuses on the financing conditions of German SMEs, which represent the backbone of the German economy.

We contribute significantly by an integrated treatment of topics which have only been addressed separately in the literature so far. Employing a large dataset for German SME's including their bank relations between 2005 and 2012, we find that the share of intangible assets significantly increases the probability of an exclusive and persistent bank relation. We expect that this finding is driven by firms which

intend to circumvent financing frictions by maintaining a strong bank relation. We also provide results contrasting accepted capital structure theories.

The fact that particularly research and development activities contribute to the creation of intangible assets makes this finding especially interesting. In addition, recent work by Cecchetti and Kharroubi (2015) illustrates the importance of financing intangible assets for real growth. They find that financial sector growth benefits industries with higher asset tangibility but harms R&D-intensive industries. This distributional effect of financial sector growth harms industries lower asset tangibility or high R&D-activities which are growth engines.

7.5.1 Policy Recommendations based on Chapter 6

The German banking system is doing well in debt-financing intangible assets due to strong firm-bank relations − regulation should not impede this. It achieves beneficial financing conditions for firms with a high share of intangible assets through strong firm-bank ties. European regulation has to take into account such country-specific characteristics. Impairing financing of intangible assets is economically undesirable, given that research and development contribute to their creation and its meaning for real growth.

7.6 Overall Summary

The present work provides a wide range of empirical results and corresponding policy recommendations. To further strengthen European integration much can be done and is actually needed. The collection of articles here provides a clear illustration that there is a lot of potential to amend the architecture of the European Union and the euro area, respectively. It is well understood that the process of European integration is a continuous process which requires adjustments from time to time.

This thesis provides results which indicate that very specific measures, such as facilitating a catch-up in terms of institutional quality by central and eastern Euro-

pean countries, would be beneficial for the process of European integration. This is in line with the general claim that institutional harmonization has to be enhanced. Moreover, the two chapters related to the euro show that within the narrower framework of the euro area measures to enhance the functioning of the single currency are needed as well. In sum, this implies a strong need for policy measures in response to the recent developments of European integration. Moreover, results of Chapter 2 show that common rules have to be equally binding for all countries.

In fact, a number of necessary policy measures are already being implemented, for example the implementation of Basel III. With respect to implementation, results in the fifth and sixth chapter imply that such measures have to be implemented carefully. Policy makers have to take into account country-specific characteristics when implementing one-fits-all policy measures. Nonetheless, the uniform European rules are not questioned here.

In addition to the results and corresponding policy recommendations, the bulk of the research done here also contributes methodologically to economics. The increasing availability of micro-data is used to address macroeconomic questions and derive corresponding macroeconomic results and implications. Future research in economics will most likely make more and more use of such data.

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Education & Research

09/2012 - 09/2015	**Zeppelin Universität, Friedrichshafen/Germany** Chair for International Economics, Prof. Dr. Jarko Fidrmuc Research fellow
12/2014 - 02/2015	**Charles University, Prague/Czech Republic** Visiting scholar at the Institute of Economic Studies
10/2004 - 10/2011	**Universität Mannheim, Mannheim/Germany** Diploma in Econmics (Diplom Volkswirt is equivalent to MSc) Majors: Macroeconomics and Banking
02/2010 - 06/2020	**Catholic University of Portugal, Lisbon/Portugal** Studies in Economics and Management
06/2008 - 08/2009	**Boston University, Boston/USA** Studies in Economics

Awards & Scholarships

2014	- Stiftung Geld und Währung (Conference Participation) - UBS International Center of Economics in Society (Participation 5th Lindau Nobel Laureate Meeting on Economic Sciences) - e-fellows.net scholarship
2013	- Verein für Socialpolitik/Deutsche Bundesbank (Award for Presenting at a selected International Conference) - Deutsches Aktieninstitut e.V. (3rd Prize Graduate Thesis Award)
2012	- A.T. Kearney (Participation Scholarship Falling Walls Lab)
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