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Financial Factors in the Economic and Monetary Union

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Financial Factors in the Economic and Monetary Union

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Financial Factors in the Economic and Monetary Union

PhD Thesis

to obtain the degree of PhD at the
University of Groningen
on the authority of the
Rector Magnificus Prof. C. Wijmenga
and in accordance with
the decision by the College of Deans.

This thesis will be defended in public on
Monday 9 November 2020 at 18:00 hours

by

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With this thesis a long-term desire has been fulfilled. Despite my deliberate choice to leave university and start working in the "real world" after I graduated, the idea to pursue a PhD always remained with me. I nevertheless shied away from openly starting such an ambitious grand project, and took a cautious approach instead. After a number of published and unpublished attempts over the years, the financial crisis and the sovereign debt crisis provided the inspiration for a clearly defined topic. Most economist will vividly remember this fascinating period, when conventional wisdoms were questioned and many new ideas took hold. In retrospect, writing a thesis certainly was not as difficult as I had feared, even though it took more time than I had hoped.

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Chapter 1

Introduction

1.1 Motivation

The sovereign debt crisis that rocked the foundations of the Economic and Monetary Union (EMU) came very unexpected.¹ This was not because potential vulnerabilities in the monetary union were unknown: EMU started in 1999 amidst skepticism from several sides. Rather, a surprisingly successful first decade had given rise to an enormous sense of optimism. In June 2008 the European Commission stated almost euphorically that “*structural budget deficits are at their lowest levels since the 1970s*” (European Commission, 2008a) and that “*EMU is a resounding success*” (European Commission, 2008b). Jonung and Drea (2009) claimed that the initial skepticism based on the theory of optimum currency areas was unfounded in their paper entitled: “*The euro. It can’t happen. It’s a bad idea. It won’t last.*” In retrospect, these statements were made only a few months before the fall of Lehmann Brothers triggered the global financial crisis. Obviously, the optimism now appears “*oddly uncritical*” (Pisani-Ferry, 2018) or even “*spectacularly ill-timed*” (Krugman, 2010).

The global financial crisis did not immediately affect the functioning of EMU. The initial financial turmoil primarily hit the large, internationally oriented banks in countries like France, Belgium and The Netherlands. These

¹ Section 1.1 contains elements of storylines published in Hessel (2016) and Hessel (2020).

banks were most exposed to the US market for subprime mortgage backed securities. The more domestically oriented banks in Southern Europe largely remained shielded from this first wave of turmoil. This changed, however, when the increase in risk-aversion and the reversal of capital flows in the aftermath of the crisis triggered the correction of the macro-financial imbalances that had been building up in the euro area. The spark that lit the fuse was that the 2009 Greek budget deficit turned out to be much higher than announced, and then things escalated quickly. Interest rates and risk premia shot up, and spillovers occurred to other vulnerable countries like Spain, Ireland, Portugal and Italy. Soon banks and governments in many member states experienced severe funding difficulties. A string of emergency summits and crisis measures by European governments could not contain the market turmoil, that slowly turned into an existential threat for the monetary union. In the summer of 2012, the European Central Bank signalled redenomination risk due to “*unfounded fears on the reversibility of the euro*” (Draghi, 2012). Only Draghi’s “*Whatever it takes*” statement and the ECB’s subsequent announcement of the Outright Monetary Transactions (OMT) programme managed to turn the tide, due to the possibility of potentially unlimited interventions in bond markets.

The surprising severity of the European sovereign debt crisis led to an understandable reappraisal of the criticisms on the monetary union that had been expressed when EMU started.² As titles like “*The revenge of the Theory of Optimum Currency Areas*” (Krugman, 2012) and “*The Theory of Optimum Currency Areas Bites Back*” (Eichengreen, 2014) suggest, analyses were sometimes carried out with a sense of “*We told you so*”. Three original lines of criticism seem particularly relevant.

²In terms of economic forecasts, especially the financial crisis in 2008 was exceptionally sudden. In its 2008 Spring Forecast, the European Commission still projected a cumulative GDP growth of 3.8 percent for 2008 and 2009 in the euro area. The actual realization was -4.1 percent, a revision of almost 8 percentage points. While the events of the sovereign debt crisis were equally unexpected, the evolution of this crisis played out more slowly, both politically and in terms of economic forecasts. In the autumn of 2011, the Commission projected a cumulative GDP growth of 2.1 percent for 2012 and 2013. The actual realization was -1.1 percent, a revision of around 3 percentage points.

A first line of criticism mainly focused on political economy factors. It was doubted whether the institutional setup of EMU was sufficiently credible to ensure macroeconomic policy discipline, both at the European level and in member states. From the monetary side, many observers were curious whether the new ECB would be able to keep inflation down as well as the illustrious Bundesbank. The ECB's somewhat idiosyncratic monetary framework - with a prominent role for monetary aggregates - was not necessarily seen as reassuring (Blanchard, 2019). It was also unclear whether member states could adjust price and wage setting practices to the new monetary environment. From the budgetary side, it was questioned whether the European fiscal rules of the Stability and Growth Pact (SGP) had sufficient "bite" to ensure that member states kept their public finances within the prescribed boundaries (Schuknecht et al., 2011) once their place in the monetary union was secured.³ Some even feared that the resulting budgetary problems in member states could lead to a banking crisis (Eichengreen and Wyplosz, 1998) and to *"pressures on [the ECB] to soften its policy stance and more generally on the Community as a whole to provide financial relief"* (European Commission, 1990).

The doubts about macro-economic policy discipline usually prompted two possible reactions. Some thought that the convergence criteria of the Maastricht treaty should be applied strictly, and considered it a mistake that the monetary union - partly for political reasons - started with a relatively broad group of countries. Others observed that the monetary union would eventually need a genuine "political union" to succeed on these political economy aspects (Feldstein, 1997a), although it often remained unclear what exactly such a political union would have to entail.

A second prominent line of criticism was based on the so-called theory of optimum currency areas (OCAs) (Mundell, 1961). Many argued that EMU would not fulfill the criteria of such an optimum currency area (for exam-

³ Others, including for example Buiter et al. (1993) questioned the rationale behind the SGP and thought it would form an unnecessary constraint on fiscal stabilisation in member states.

ple Brakman and Garretsen, 1996). Compared to the US, European member states had a higher risk of country-specific (or asymmetric) shocks (Bayoumi and Eichengreen, 1993).⁴ Unlike the US, they also lacked the adjustment mechanisms to deal with these shocks. Cross-border labour mobility was lower (Décressin and Fatás, 1995), flexibility of wages and prices was lower, and a federal budget was absent (Sala-i-Martin and Sachs, 1992). As a result, European countries would find it much harder than US states to cushion asymmetric shocks after giving up their national monetary policies. This would hamper the functioning of EMU, as it would increase asymmetries and reduce the resilience to shocks. The Maastricht treaty paid no attention to these considerations on the real side of the economy, as it focused on the monetary side of EMU (Wyplosz, 2006). The critical view based on the theory of optimum currency areas was not undisputed, however. Some argued that it was too pessimistic, as the single currency would increase trade integration and thereby endogenously increase the symmetry of cycles in the monetary union (Frankel and Rose, 1998). This so-called “endogenous OCA hypothesis” was embraced enthusiastically by many policymakers when EMU started.⁵

A third and final line of criticism focused on the banking sector, although this approach did not get nearly as much attention as the other two at the time. Folkerts-Landau and Garber (1992) feared that the euro area would be vulnerable in the case of a banking crisis, as it was unclear whether the ECB could act as lender of last resort for banks. James (2012) describes how especially the European Committee of Central Bank Governors discussed plans to also transfer banking supervision to the European level at the ECB. These plans were met with so much (political) resistance, however, that they were eventually shelved. This was not at all seen as a major omission in the setup of EMU. In the famous report “*One Market, One Money*” (European

⁴ De Haan et al. (2002) find only mixed evidence of increased business cycle synchronization in the US. See also chapter 3 on this issue.

⁵ More recent studies, including Inklaar et al. (2008), show that trade integration does lead to more business cycle synchronisation, but that the effect is much smaller than Frankel and Rose (1998) claimed.

Commission, 1990) the term “*supervision*” only figures once - in a footnote.

In hindsight, all three lines of criticism did foresee important vulnerabilities in the initial setup of the monetary union. Of course this is not to say that there were no good reasons to go ahead with EMU. At the time of the Maastricht treaty, monetary unification had become a logical step for both economic and political reasons. Economically, the strong increase in capital mobility had left countries more and more vulnerable to currency crises, while the frequent exchange rate realignments made it difficult to fully reap the benefits of the European single market. This significantly reinforced the economic arguments for a monetary union that had circulated since the 1970 Werner report. (Geo)politically, the German reunification provided both a reason and an opportunity to anchor Germany more robustly within a united Europe. Nevertheless, it is now clear that European policymakers were too optimistic and may have dismissed the criticisms too easily.⁶ They had for instance been too optimistic about the ability to discipline member states with European (budgetary) rules. Although the Stability and Growth Pact has had some disciplining effect (Gilbert and De Jong, 2018), full compliance has been a problem since the very beginning. Policymakers have also underestimated the danger of asymmetries and divergences between member states. It is now clear that vulnerabilities were already building up in the first decade of EMU, such as divergences in price competitiveness and current account balances. These imbalances somehow remained largely under the radar at the time.

Yet it is far too easy to suggest that all problems could have been foreseen before EMU started. In a way, the original critique on the monetary union resembles the story of the blindfolded men that describe an elephant: each of them adequately describes a part of the problem, but nobody is able to see the full picture. Many aspects of the EMU crisis cannot be explained

⁶ An alternative interpretation is that policymakers did have some idea of the incompleteness of EMU, but were expecting to make up for these omissions with new policy measures in the future, in line with Jean Monnet’s functionalist approach to European integration (Guiso et al., 2015).

by the original criticisms either. Important puzzles remain, for example on fiscal policy. The budgetary problems are often blamed on lack of fiscal discipline and the inadequate budgetary framework. But this cannot explain the problems in Spain and Ireland, that had budgetary surpluses before the crisis. More important was that many countries experienced an unusually large budgetary deterioration, as the correction of macroeconomic imbalances led to a large decline in domestic demand and public revenue (Gilbert and Hessel, 2014).

A similar problem emerges with the original criticism based on the theory of optimum currency areas. The theory had failed to foresee that high public debts could become a source of crises and thus asymmetric shocks. This aspect of the monetary union was better predicted in the Maastricht treaty.⁷ More importantly, while many proponents of the OCA theory had warned for the abstract notion of asymmetries, only very few pointed to the actual divergences that turned out to be crucial: in price competitiveness, current account balances and the growth of credit and house prices. On the contrary, some point out that short-term business cycles have become more synchronized (Campos and Macchiarelli, 2016). This synchronization, which has probably been helped by the strong increase of supply chains in international trade, paints a positive picture of EMU, which largely ignores the large asymmetries that occurred during the sovereign debt crisis. So in short, *both* the architects of EMU *and* their critics have missed important aspects of the sovereign debt crisis.

The reason for this is that the tectonic plates in the economy were shifting. The original setup of EMU was mainly focused on *nominal* factors, like inflation, interest rates and budget deficits. This made sense, because the most important macroeconomic problems in the 1970s and 1980s were in these areas. Meanwhile, the criticism of EMU from the theory of optimum currency areas was based on *real* factors, like asymmetric shocks and ad-

⁷ Unfortunately, as mentioned above, the safeguards in the Maastricht treaty to prevent these problems proved insufficiently effective.

justment mechanisms. However, in the last decades *financial* factors have become much more important in almost all advanced economies. This sea change resulted from the deregulation of financial sectors and the liberalization of international capital flows since the early 1990s. The start of EMU happened to coincide with a period of rapid financial development and integration worldwide. In the euro area, this was stimulated even further as the single currency reduced exchange rate risk (Forbes, 2012). To illustrate the pervasive nature of the change: the average size of foreign assets and liabilities in euro area countries increased from around 70% of GDP in the mid-1990s to almost 300% of GDP just before the financial crisis. It is no surprise that the increasing importance of financial factors affected the functioning of the monetary union. Just like many advanced economies found it difficult to deal with the consequences of *financialization*, the monetary union was not well-suited to weather the change either. The financial factors interacted with rigid economies in member states and the incomplete institutional setup of the monetary union. Financialization amplified some of the vulnerabilities that already existed in EMU, and also created new ones that had not been foreseen.

Several papers describe how the increased importance of financial factors affects the functioning of EMU (Lane, 2013; Obstfeld, 2013). Yet it is not always fully clear how the financial factors influenced specific aspects of the sovereign debt crisis. This thesis therefore investigates several important aspects of the functioning of EMU in light of this increased importance of financial factors. These aspects include: the emergence of large current account deficits and surpluses, the asymmetry of fluctuations in the euro area and the strong increase in sovereign bond yields at the height of the euro crisis. Each of these was controversial and therefore discussed intensively since the beginning of the crisis. Some of the controversies remain to this day. We argue that these aspects can only be understood properly by taking financial factors into account - even those that are centered on the real side of the economy. Taking into account financial factors is crucial to understand these phenomena and the political controversies that surround

them. We also argue that failing to take financial factors into account could lead to inadequate policy prescriptions for the future of EMU.

1.2 Outline

Chapter 2 investigates the current account imbalances in EMU: the increasing deficits in Southern Europe and increasing surpluses in Northern Europe. While these imbalances were at the heart of the sovereign debt crisis, there is no consensus on their causes. Some attribute the imbalances to differences in price competitiveness, a *real* factor. This often leads to pleas for structural reforms that speed up the adjustment of wages and prices, and sometimes even for a temporary exit from the euro (Sinn and Sell, 2012). Others point, however, to a *financial* factor: differences in domestic demand driven by changes in savings and increases in credit and house prices. This means that the imbalances would partly correct automatically, when households and companies start deleveraging. A change in relative prices only plays a marginal role in that process. Both causes therefore have very different policy implications.

This chapter aims to investigate the relative importance of price competitiveness and financially driven demand booms as explanations for the (changes in) current account balances in the euro area. We estimate several models for the current account balance or important components thereof, with among the explanatory variables price competitiveness and a measure of domestic demand or the financial cycle. We first estimate price and income elasticities in panel models for trade flows. Relatively new is that we estimate a separate equation for imports, taking into account domestic demand. We then regress trade and current account balances on a number of fundamental and cyclical factors. A new element here is that we use several financial cycle measures and other medium-term fluctuations, instead of the "normal" economic cycle. We then determine how much price competitiveness and financially driven factors contribute to the (components of)

the current account in each of these models.

We find that differences in price competitiveness matter for the changes in current account balances in the euro area, but that differences in domestic demand and the financial cycle are more important. Including the financial cycle or medium-term fluctuations clearly reduces the importance of price competitiveness. We also find that financial cycles and medium-term fluctuations better explain the evolution of current account balances than normal business cycles. Our results call for more emphasis on financial imbalances and macro prudential policy, in addition to the attention for price competitiveness and structural reforms.

Chapter 3 looks at the symmetry of fluctuations in EMU. Normal short-term fluctuations have been surprisingly symmetric in EMU, even during the crisis. This finding leads to benign views on the functioning of EMU as an optimum currency area (Campos and Macchiarelli, 2016), that are difficult to reconcile with the sovereign debt crisis. The crisis is sometimes seen as *“the mother of all asymmetric shocks”* (Krugman, 2012), and was accompanied by persistent divergences in the growth of credit and house prices, in price competitiveness, current account balances and budget deficits. We try to solve this puzzle by looking at medium-term fluctuations instead.

Our hypothesis is that looking at medium-term fluctuations leads to a less benign view on the functioning of EMU as an optimum currency area, that is more in line with the sovereign debt crisis. We first investigate whether medium-term fluctuations in the euro area are less symmetric than short-term fluctuations. We then analyse whether these medium-term fluctuations are relevant for the functioning of EMU. We look at the relative role of *real* drivers (productivity) and *financial* drivers (credit and house prices). Fluctuations driven by financial factors may cause imbalances and crises, and are therefore more harmful for the functioning of EMU. We also investigate whether the imbalances in price competitiveness, current accounts and budget deficits in EMU can be related to medium-term rather than short-term fluctuations.

We reach a number of conclusions. In the first part of the analysis, we find that medium-term fluctuations in EMU are much larger and less symmetric than short-term fluctuations. Moreover, medium-term fluctuations have become larger and less symmetric over time, while short-term fluctuations have become smaller and more symmetric. Medium-term fluctuations in EMU are also less symmetric than in the US, while short-term fluctuations are more symmetric. In the second part of the analysis, we find that medium-term fluctuations in the euro area have become more strongly correlated with financial variables like credit and house prices, and less strongly correlated with real variables like productivity. In addition, medium-term fluctuations are more closely related to imbalances in price competitiveness, current accounts and budget deficits than short-term fluctuations. We conclude that our medium-term perspective has become relevant in the monetary union, due to the increasing importance of financial factors. It leads to less benign views on the functioning of EMU and on the endogenous OCA hypothesis.

Chapter 4 investigates the nature of the increase in interest rates on sovereign bonds during the sovereign debt crisis.⁸ This issue is controversial, as there is lack of consensus on the nature of the fragilities in European bond markets. Some see higher spreads as a rational reaction to increased insolvency risk due to deteriorating fundamentals (Issing, 2009). In this vision, financial support via the European Stability Mechanism (ESM), via ECB interventions like the OMT or via safe assets like eurobonds carry large financial risks. They also create moral hazard because financial market discipline is reduced. By contrast, some argue that higher spreads result from overshooting financial markets, where excessive risk aversion can drive spreads away from fundamentals. In this view, liquidity support is justified as self-fulfilling expectations could turn liquidity problems into solvency problems (De Grauwe, 2012a). It is therefore very important to

⁸This chapter was published as L. de Haan, J. Hessel and J. van den End (2014). Are European Sovereign Bond Yields Fairly Priced? The Role of Modelling Uncertainty, *Journal of International Money and Finance*, vol. 47(3), pp. 239-267.

know whether and to what extent sovereign yields of euro countries are misaligned compared to fundamentals. The answer determines whether market discipline can be relied on, or whether forms of financial support are needed.

This chapter examines the extent to which the sovereign yields in euro area countries during the debt crisis can be attributed to fundamentals, focusing on the inherent uncertainty in bond yield models. We estimate reduced form models for bond yields, using macroeconomic fundamentals, market volatility and market liquidity as explanatory variables. This modelling choice is motivated by the question of whether bond yields are fairly priced with respect to fundamentals and market conditions. Misalignment occurs if the actual yield is outside the confidence band of the model's predictions.

Our main conclusion is that bond yields sometimes display fluctuations that cannot be explained by macroeconomic fundamentals. This suggests that some mispricing and overshooting took place. At the same time, our approach differs from much of the literature by warning against drawing too strong conclusions. By estimating several specifications, we show that the outcomes are strongly affected by modelling choices, in particular with regard to i) the confidence bands for the model prediction, ii) the assumption whether the model coefficients are similar across countries or not, iii) the sample selection, iv) the inclusion of financial variables and v) the choice of time-varying coefficients. These choices affect the explanatory power of macro fundamentals and the extent of mispricing. The precise extent to which bond yields are misaligned is therefore highly uncertain, and should be interpreted with great caution.

Chapter 5 applies the findings of previous chapters together with broader insights to the policy debates on the institutional setup of the mon-

etary union.⁹ The chapter reviews the literature since the eruption of the euro crisis in 2010 and analyses the reforms in the architecture of EMU that have been implemented. The chapter first describes the major weaknesses in the original set-up of EMU, that appeared against the background of a strong increase in financial integration and financial imbalances since the Maastricht treaty was signed. The main weaknesses were a lack of fiscal discipline, insufficient attention for diverging financial cycles and competitiveness positions, a lack of financial support instruments to contain crises and a strong negative feedback loop between banks and governments in member states.

We then describe how European policymakers addressed all weaknesses in some way or the other. In a relatively short time, European member states introduced a revised Stability and Growth Pact (SGP), a new Macroeconomic Imbalances Procedure (MIP), the European Stability Mechanism (ESM) and European mechanisms for banking supervision (SSM) and bank resolution (SRM). These reforms are a major achievement. Yet, the effectiveness of the new framework will crucially depend on strict implementation, and this is not guaranteed. We conclude that an imbalance looms between the degree of risk sharing and the degree of national sovereignty.

We then discuss whether in the longer run the current balance between policy coordination and risk sharing can be improved upon. This almost unavoidably requires a fundamental choice to move closer towards one of two broad solutions: either a monetary union with a higher degree of (explicit) risk sharing and more curtailed sovereignty, or a union based on the retention of a form of market discipline and a formal mechanism for public debt restructuring. At the same time, both alternatives will only become (politically) feasible after current vulnerabilities in the monetary union have been dealt with, in particular the high public debt overhang in many countries.

⁹ This chapter was published as J. de Haan, J. Hessel and N. Gilbert (2016), *Reforming the architecture of EMU: Ensuring stability in Europe*, Routledge Handbook of the Economics of European Integration, p. 408-429.

To conclude, this thesis shows that financial factors played a pivotal role in several important and hotly debated aspects of the functioning of EMU. These include the evolution of current account imbalances, the asymmetry of fluctuations and the increase in sovereign bond yields during the euro crisis. Taking into account financial factors leads to a better understanding of these phenomena and also to different policy prescriptions. For example, our results call for more emphasis on macroprudential policy to prevent future current account imbalances. Our results also suggest that financial cycles lead to much larger growth divergences than often assumed. This requires a clearer medium-term perspective in (macroeconomic) policy frameworks. Finally, financial support mechanisms like the ESM or the ECB's OMT are needed for financial stability. While several of these recommendations have been implemented, it remains unclear whether EMU has been strengthened enough to weather the future influence of financial factors (see chapter 6 for this).

Chapter 2

Current Account Imbalances in the Euro Area: Price Competitiveness or Financial Cycle?*

2.1 Introduction

"There are apparently two very different ways to analyse movements in current account balances: as the result of changes in the difference between 1) exports and imports, and 2) savings and investment. Some observers think in terms of the former, some in terms of the second and both talk past each other."

Bénassy-Quéré et al., 2019

It is by now well-established that current account imbalances are at the heart of the European sovereign debt crisis (Pisani-Ferry, 2012; Baldwin and

* This chapter is a substantially revised version of Comunale and Hessel (2014). With many thanks for useful comments and suggestions to Dirk Bezemer, Beata Bierut, Steven Brakman, Peter van Els, Gabriele Galati, Jakob de Haan, Leo de Haan, Philip Lane, Robert Vermeulen, two anonymous referees, participants of the 2014 Royal Economic Society Postgraduate Presentation Meeting & Job Market at University College London on 10-11 January 2014, a seminar at the Bank of Lithuania in Vilnius on 15 May 2014, the CEUS workshop on European Economics in Vallendar/Koblenz on May 22-23 2014 and two anonymous referees.

Giavazzi, 2015). At the same time, there is no consensus yet on the exact causes of the buildup and correction of the large deficits in the periphery and large surpluses in the core of the euro area (see figure 2.1a). While some point at the importance of *real* economic factors like differences in price competitiveness, others emphasize the role of *financial* factors like differences in savings rates and in the growth of credit and house prices.

From early on in the crisis, the strong divergence in price competitiveness since the start of EMU was seen as a prominent cause of the current account imbalances (European Commission, 2009). Differentials in inflation and the growth of unit labour costs were very persistent (see figure 2.1b). Part of this is because the possibility of exchange rate adjustments had vanished in EMU. In addition, the responsiveness of relative prices in EMU seems low due to structural rigidities in labour and product markets (Biroli, Mourre and Turrini, 2010; Jaumotte and Morsy, 2012; Santos Monteiro, 2017). These differences in price competitiveness were seen as the main driver of differences in exports (see figure 2.1c) and possibly imports (Horn and Watt, 2017).

Only later in the debate, another line of research started to suggest that domestic demand booms were an important cause of the current account deficits in southern Europe (Wyplosz, 2013; Diaz Sanchez and Varoudakis, 2013).¹ These demand booms were mainly driven by a decline in (household) savings, due to financial factors like low and declining interest rates, better availability of credit due to financial liberalization and increases in house prices. The euro area did experience surprisingly large and long-lasting divergences in the strength of domestic demand (see figure 2.1d)

¹ Somewhat surprisingly, the link between credit driven demand booms and current account imbalances came relatively late in the policy debates for the euro area, even though it was well-established in the academic literature. Mendoza and Terrones (2012), for example, show that credit booms tend to boost domestic demand and widen external deficits. Vice versa, Lane and McQuade (2014) show that net capital inflows (as measured by, for instance, current account deficits) tend to increase domestic credit growth. Jordà, Schularick and Taylor (2011) show that the link between credit booms and current account deficits has become much closer in recent decades.

Figure 2.1. Stylized facts current account balances euro area

Note: core countries are Austria, Belgium, Germany, Finland, France, Luxembourg and The Netherlands. Periphery countries are Greece, Ireland, Italy, Portugal and Spain. Source: European Commission AMECO database, OECD, BIS.

and in the growth of real credit (see figure 2.1e) and real house prices (see figure 2.1f). These financial factors were seen as important drivers of the current account imbalances, in line with research on the so-called financial cycle (Drehmann, Borio and Tsatsaronis, 2012; Borio, 2012b). The financial cycle is an economic fluctuation that is mainly driven by credit and house price growth, and has a much wider amplitude and longer duration than normal business cycles.² The strength of credit and house prices before the crisis was largely a global phenomenon (Hessel and Peeters, 2011), but in the euro area important divergences emerged. This was partly because the financial liberalization of the 1990s took place in member states in very different stages of economic and financial development (Marzinotto, 2018). It was also fuelled by the decline of real interest rates in the periphery due to EMU membership (Holinsky, Kool and Muysken, 2012; Gilbert and Pool, 2016). In this literature, the increase in unit labour costs is seen as a byproduct of domestic demand growth that happens mainly in the non-tradable sector, not as the main cause of the current account deficits (Gaulier and Vicard, 2012; Gabrisch and Staehr, 2012).

In practice, price competitiveness and demand booms driven by the financial cycle have likely both affected the evolution of current account balances (Martin and Philippon, 2017). Both developments may even have reinforced each other in the monetary union (Hessel, 2019). On the one hand, the long-lasting nature of finance-driven demand has caused a longer-lasting divergence in relative prices. On the other hand, the divergence in relative prices and inflation caused longer-lasting differences in real interest rates that amplify the financial divergences: the *Walters' Effect* (Mongelli and Wyplosz, 2008, Buti and Turrini, 2015; Bonam and Goy, 2017).

Nevertheless, it remains important to determine the relative importance of these real and financial drivers, as both have very different policy implications. If the current account imbalances were mainly driven by real fac-

² While normal business cycles have a frequency of up to 8 years, the frequency of the financial cycle is thought to be between 16 and 20 years (Borio, 2012b).

tors, restoring price competitiveness is key. The focus on competitiveness usually leads to a plea for structural reforms on product and labour markets, that would strengthen the adjustment of relative prices. Such reforms figure prominently in existing European mechanisms like Europe 2020 and the macroeconomic imbalance procedure (MIP). However, more controversial solutions have also been proposed, such as a higher inflation target (Darvas, 2012) or a temporary euro exit to devalue the exchange rate (Sinn and Sell, 2012). By contrast, if the current account imbalances were mainly caused by financially driven demand booms, they could partly correct without an (immediate) adjustment in relative prices. A turn in the financial cycle could lead to a long-lasting correction in domestic demand, as banks, households and companies increase savings to reduce debt (a process known as deleveraging). A change in relative prices or an exchange rate devaluation would only have a small effect on this process. Rather, policies like cleaning up bank balance sheets or an effective macro-prudential policy framework would be important (Schoenmaker, 2013).

This paper therefore aims to investigate the relative role of price competitiveness on the one hand and of domestic demand, credit and house prices on the other hand for current account imbalances in the euro area. We use two different approaches. First, we estimate panel error-correction models for exports and imports for euro area countries. We use various measures of the real effective exchange rate for price competitiveness, and try to distinguish between tradable and non-tradable prices (Ruscher and Wolf, 2009; Kang and Shambaugh, 2013). Relatively new is that we estimate a separate equation for imports, taking into account differences in the strength of domestic demand. Second, we estimate panel models for the trade balance and the current account balance on a number of fundamental and cyclical factors, including the real effective exchange rate and the output gap. New in our approach is that for the output gap we also use several measures for the financial cycle and for medium-term fluctuations from the recent literature (such as Stremmel, 2015 and Alcidi, 2017).

We find that price competitiveness has an influence on trade flows and current account balances, but we also find robust evidence that domestic demand and the financial cycle have been more important. This finding is robust across both approaches. From our trade equations, it emerges that the influence of price competitiveness is clearest for exports. Yet the influence of external demand on exports is also large, confirming that the destination and composition of exports matter (Chen et al., 2012; Wierds et al., 2014). The influence of competitiveness on imports is more difficult to find (in line with Christodouloupoulou and Tkačevs, 2014), and domestic demand is the most important driver of imports. This conclusion is confirmed by the estimations for trade and current account balances, where including the financial cycle or medium-term fluctuations in domestic demand reduces the importance of competitiveness. Differences in the financial cycle or domestic demand are therefore more important than differences in price competitiveness (in line with Wyplosz, 2013, Diaz Sanchez and Varoudakis, 2013 and Marzinotto, 2018). Moreover, financial cycles and medium-term fluctuations explain the movements in trade and current account balances much better than normal business cycles.

The paper is structured as follows. Section 2.2 reviews the literature. Section 2.3 describes our methodology and section 2.4 the data. Section 2.5 presents the results and section 2.6 concludes.

2.2 Literature

2.2.1 Mechanisms and causes

The literature describes the mechanisms and underlying causes that influence the evolution of current account imbalances in the euro area. While some research sees *real* factors as the main cause (the "*price competitiveness view*"), other research sees *financial* factors as the main cause (the "*financial cycle view*"). In the "*competitiveness view*", a prominent cause of the current account imbalances is the strong and persistent divergence in inflation and

in the growth of unit labour cost since the start of EMU (European Commission, 2009; Horn and Watt, 2017). These differences in price competitiveness directly affect export performance especially, and possibly also import performance (figure 2.2, left panel). The divergence in competitiveness is normally attributed to several causes. On the one hand, Germany engaged in a period of price and wage moderation to restore price competitiveness after the reunification. On the other hand, other countries in especially Southern Europe failed to adjust their price and wage setting habits to the fact that the possibility of exchange rate adjustments had vanished in the monetary union. More generally, the overall responsiveness of relative prices in the euro area seems low due to structural rigidities in labour- and product markets (Biroli, Mourre and Turrini, 2010; Jaumotte and Morsy, 2012; Santos Monteiro, 2017).

Figure 2.2. Stylized representation causes current account imbalances

The "*financial cycle view*" suggests that divergences in the growth of credit and house prices caused divergences in (private) savings rates and domestic demand growth that led to the evolution of current account imbalances in the euro area (Wyplosz, 2013; Diaz Sanchez and Varoudakis, 2013). The link between credit booms and current account imbalances is

well-established in the wider academic literature (Jordà, Schularick and Taylor, 2011; Mendoza and Terrones, 2012), yet was made relatively late in the debate on the euro area. The main mechanism is that the financial accelerator amplifies and prolongs fluctuations in private savings rates and domestic demand, via movements in asset prices, credit and private debt (figure 2.2, right panel).³ Especially the growth in credit and house prices play a prominent and interacting role. Credit grows as households decrease savings and increase borrowing when financial factors affect the price and availability of credit. Declining interest rates decrease the cost of borrowing, while financial deregulation may increase banks' willingness to lend and could lead to innovations that increase the capacity to borrow (Marzinotto, 2018).⁴ Fluctuations in house prices also affect savings rates and domestic demand, because they affect the wealth of house owners. Moreover, higher (expected) house prices increase the (future) value of collateral and make it easier to obtain mortgage credit.

The domestic demand booms and declines in savings rate tend to widen external deficits in a number of ways (figure 2.2, right panel). The main effect occurs via trade flows and especially imports. The demand boom directly leads to higher demand for imported goods. More indirectly, the boom may lead to a strong growth of the non-tradeable sector (where prices and wages increase) compared to the tradeable sector (where it is more difficult to increase prices and wages as this reduces price competitiveness). This could reduce the capacity to produce tradeable goods and affect both exports and imports (Gilbert and Pool, 2016). Apart from the trade balance, other ele-

³ In theory, the factors described here could also affect *public* savings. In previous waves of financial crises, a strong increase in budget deficits has also been among the drivers of current account deficits, the so-called *twin deficits*. However, fluctuations in public savings did not play a prominent role in the evolution of current accounts in the euro area, possibly with the exception of Greece. In most EMU countries fiscal policy played a *countercyclical* role, although possibly not as strongly as desirable for financial cycles (Gilbert and Hessel, 2014; Hessel, 2019). Countries like Spain and Ireland had budget surpluses before the crisis, while budget deficits plummeted during the crisis because the increase in private savings caused a strong decline in public revenue.

⁴ Think for example of changes in amortization requirements, the introduction of interest-only loans or financial products that maximize the possible tax-deductibility of interest payments.

ments of the current account balance may also be affected (Holinsky et al., 2012; Shambaugh, 2012), for example because higher external borrowing leads to more interest payments to foreign creditors. In this literature, the increase in relative prices and unit labour costs does occur, but is primarily seen as a byproduct of domestic demand growth instead of the the main cause of the current account deficits (Gaulier and Vicard, 2012; Gabrisch and Staehr, 2012). This is also because a significant part of the price changes occur in the non-tradeable sector (Ruscher and Wolf, 2009; Gilbert and Pool, 2016).

According to this "*financial cycle view*", the current account imbalances occurred because these financial mechanisms were asymmetric in the euro area. They were much stronger and more volatile in Southern Europe than in Northern Europe. While the strength of credit and house prices before the crisis was a global phenomenon, Germany and Austria were somehow among the (few) exceptions (Hessel and Peeters, 2011). In addition, the financial liberalization of the 1990s took place in member states that were in very different stages of economic and financial development (Marzinotto, 2018) and hence had very different expectations of future growth potential (Giavazzi and Spaventa, 2010). The difference has also been fuelled by declining real interest rates in especially the periphery due to EMU membership (Holinsky, Kool and Muysken, 2012; Gilbert and Pool, 2016). Finally, the persistent divergence in inflation and inflation expectations caused longer-lasting differences in real interest rates that have further fuelled the divergence in the growth of house prices, credit and domestic demand (Bonam and Goy, 2017).

These domestic financial mechanisms are also affected by the strength and direction of international capital flows. Before the crisis, capital inflows enabled peripheral countries to finance large current account deficits and amplified the credit boom (Lane and McQuade, 2014; Samarina and Bezeemer, 2016). By contrast, the financial fragmentation during the crisis (Baldwin and Giavazzi, 2015) was accompanied by capital outflows that acceler-

ated and amplified the adjustment of current accounts (Martin and Philippon, 2017). The public sector financial aid that became available via the ESM and the ECB softened part of the adjustment (Gross and Alcidi, 2015b).

The role of financial factors suggests that the evolution of current account imbalances in the euro area could be related to the financial cycle, even though we are not aware yet of any research that links them directly. The financial cycle is mainly driven by credit and house price growth, and has a much larger amplitude and longer duration than normal business cycles (Drehmann, Borio and Tsatsaronis, 2012; Borio, 2012b). While normal business cycles have a frequency of up to 8 years, the frequency of the financial cycle is thought to be between 16 and 20 years. Research to quantify and characterize the financial cycle is growing quickly. Financial cycles have often been derived from financial variables (Galati et al., 2016). Several papers use statistical filter over lower (medium-term) frequencies on for example credit to GDP-ratio (Drehmann et al., 2010), on credit, on house prices or a combination of the three (Stremmel, 2015; Alcidi, 2017). Other research more systematically links financial variables with GDP. Borio, Disyatat and Juselius (2013) adjust output gaps by estimating a relationship between GDP, credit and house prices. Others filter GDP-data that are corrected for fluctuations in the current account to come up with something resembling a domestic absorption gap (Dobrescu and Salman, 2011; Lendvai, Moulin and Turrini, 2011). Hessel (2019) shows that medium-term fluctuations in GDP and domestic demand in the euro area have become much more strongly correlated with fluctuations in credit and house prices.

2.2.2 Empirical evidence

In practice, price competitiveness and demand booms driven by the financial cycle have likely both affected current account balances (Martin and Philippon, 2017), and have probably reinforced each other in the monetary union (Hessel, 2019). Nevertheless, it remains important to determine the

relative importance of these real and financial drivers. The relevant empirical literature can roughly be divided into three separate strands. This literature varies quite substantially in methodological approaches and in results, both between and within the strands.

A first important strand of the empirical literature relies on the estimation of price and income elasticities in aggregate export and import equations (Goldstein and Khan, 1995; Clarida, 1996; Hooper, Johnson and Marquez, 2000; Funke and Nickel, 2006). This traditional strand of literature often uses a relatively narrow range of determinants for individual trade flows, with a particular focus on measures for income and price competitiveness. Exports often depend on a measure of relative prices (such as the real effective exchange rate) and a measure of (country specific) foreign demand. Imports usually depend on domestic demand and a relative price measure. Relatively similar approaches are also applied directly to the trade balance in the literature on the so-called “J-curve” (Goldstein and Khan, 1985; Alvarez-Ude and Gómez, 2006).⁵ Despite the relatively unified approach towards the determinants, there remains quite some diversity in the specific methodologies and estimation strategies in this strand of the literature.⁶

The application of these methodologies to the euro area shows that price competitiveness clearly matters, but with important qualifications. Price competitiveness has a clear influence on exports (Di Mauro, Forster and Lima, 2010; Bayoumi et al., 2011; Christodouloupoulou and Tkačevs,

⁵ The literature on the J-curve is concerned with the effect of the real exchange rate on the trade balance. In the long run, a devaluation should improve the trade balance. However, in the short run the balance may deteriorate first (the J-curve effect) because quantities only adjust slowly. Estimations show that the presence of a “J-curve” effect is at best ambiguous (Alvarez-Ude and Gómez, 2006; Bahmani-Oskooee and Ratha, 2004).

⁶ For example, studies vary considerably in their estimation strategy. While Wierds et al. (2014), Christodouloupoulou and Tkačevs (2014) and Van Limbergen and Vermeulen (2020) estimate equations in first differences, Hooper et al. (2000), Funke and Nickel (2006) and Bayoumi et al. (2011) use error-correction models due to cointegration. Also the estimation methods vary widely from OLS (Bayoumi et al, 2011) to Pooled Mean Group estimation (Funke and Nickel, 2006), GMM (Wierds et al., 2014) and robust regression (Van Limbergen and Vermeulen, 2020).

2014), but the effects are less clearly visible for imports (Funke and Nickel, 2006; Christodouloupoulou and Tkačevs, 2014). Moreover, the estimated elasticities differ quite substantially depending on the measure of the real effective exchange rate (REER) used (Bayoumi, Harmsen and Turunen, 2011). Another important finding is that exports are also affected by other factors. One is the euro exchange rate (Darvas, 2012; Chen et al., 2012), that may affect individual member states in different ways.⁷ Another relevant factor is the destination and composition of exports. While German exports of capital and durable consumer goods benefited from high demand in emerging markets and oil producers, Southern European exports face increasing competition from low wage countries like China (Chen et al., 2012). More generally, a higher share of high tech exports increases the elasticity of exports to foreign demand, while it reduces the price elasticity of exports (Wierds, Van Kerkhoff and De Haan, 2014). Finally, Van Limbergen and Vermeulen (2020) find that the influence of price competitiveness on European trade flows is negligible, as exports and imports are to an important extent driven by global value chains. All in all, it remains unclear how much of the differences in trade flows are determined by price competitiveness.

A second and more recent strand of studies questions whether price competitiveness is the only - or even the dominant - driver of current account imbalances in the euro area. The methodologies are much more diverse, but include vector auto regression (VAR) models that directly include the current account balance itself. Ruscher and Wolff (2009) underline that the differentials in unit labour costs growth are strongly related to wages in the non-tradable sector, that have little effect on export performance. Gaulier and Vicard (2012) find that growth in unit labour costs in euro area countries was highly correlated with the growth of imports, while the correlation with

⁷ One implication is that exports to countries outside the euro area may have a different price elasticity than those to countries within the euro area (Chen et al., 2012). Another implication is that the rebalancing of trade flows that may be needed to reduce current account imbalances is not a purely internal process (Darvas, 2012). Therefore the division of the adjustment between core and periphery countries matters. An adjustment via higher inflation in core countries would, for instance, hurt the competitiveness of the euro area as a whole.

export growth was low. Gabrisch and Staehr (2015) confirm that the current account deficit Granger causes relative unit labour cost growth, but not vice versa. Staehr and Vermeulen (2016) find that (short-term) shocks in price competitiveness have little direct effect on current account balances, while Diaz Sanchez and Varoudakis (2013) find that competitiveness shocks were much less important than domestic demand shocks and shocks in the real interest rate.

A comparable qualification of the role of price competitiveness emerges from a third strand of literature related to the debate on "global current account imbalances". This approach focuses on the current account as a whole, rather than on individual trade flows. It also uses a broader range of potential determinants in addition to price and income measures. In this literature, the current account is often explained by a number of "fundamental" long-term determinants, such as the level of economic development or the ageing of the population (Lane and Milesi-Ferretti, 2015; Darvas, 2015). The deviation from this long-term value can either be seen as an imbalance (Darvas, 2015) or can be explained by cyclical factors like domestic demand and price competitiveness (Lane and Milesi-Ferretti, 2015). Marzinotto (2018) explains the current account imbalances in the euro area by measures for financial liberalization, that have lifted liquidity constraints and lead to a decrease in saving especially in countries with lower levels of economic and financial development.

All in all, these studies suggest that it is worthwhile to revisit the roles of price competitiveness, domestic demand and the financial cycle from various angles. As far as we are aware, however, there is relatively little direct evidence of a strong role of domestic demand and financial variables like credit and house prices in the evolution of current account imbalances in the euro area.

2.3 Methodology

2.3.1 Model exports and imports

We look at the relative importance of price competitiveness, domestic demand and the financial cycle in explaining current account imbalances in a panel for euro area countries. We use two different approaches that are related to two strands of literature mentioned above (section 2.2.2). This should contribute to the robustness of our results, because both approaches not only use different methodologies, but also a different range of potential determinants. In the first approach, we add to the strand literature on trade equations for the euro area (Bayoumi, Harmsen and Turunen, 2011; Christodouloupoulou and Tkačevs, 2014; Wierds et al., 2014; Van Limbergen and Vermeulen, 2020). Relying on the usual approach in this literature, we estimate price elasticities and income elasticities for exports and imports. We then compare the influence of price competitiveness, domestic demand and foreign demand.

We estimate separate equations for exports and imports, in line with the traditional literature that is surveyed by Goldstein and Khan (1985). However, our main choices are derived from the more recent application of this methodology to the euro area (see Hooper, Johnson and Marquez, 2000; Funke and Nickel, 2006).⁸ For example, the attention for imports is relatively new in the literature on euro area current account imbalances (see Funke and Nickel, 2006; Christodouloupoulou and Tkačevs, 2014; Van Limbergen and Vermeulen, 2020). Our model follows the structure of a dynamic panel data model with lagged dependent variables, which is crucial to control for the dynamics of the process. In this case we use the Autoregressive Distributed Lag (ARDL) model (Pesaran et al., 1997) with one lag for the de-

⁸ These recent papers sometimes make different choices. For example, Goldstein and Khan (1985) argue that it may be necessary to estimate both supply and demand equations for exports and imports, among others to account for effects countries may have on (relative) prices. However, none of the recent applications to the euro area makes this distinction between supply and demand, implicitly assuming that euro area countries are small countries and therefore price takers.

pendent variable, while the regressors are added contemporaneously and lagged by one period.⁹ All variables are expressed in logs.

In line with Hooper et al. (2000), Funke and Nickel (2006), Bayoumi et al. (2011) and Christodouloupoulou and Tkačevs (2014), aggregate exports in our model depend on two variables: price competitiveness, proxied by various measures of the real effective exchange rate ($reer_{i,t}$, section 2.4) and country-specific foreign demand ($fd_{i,t}$), depending on the destinations of exports (see section 2.4). In line with Di Mauro, Forster and Lima (2010) and Bayoumi, Hansen and Turunen (2011) our ARDL framework becomes:

$$xp_{i,t} = c + c_i + xp_{i,t-1} + reer_{i,t} + reer_{i,t-1} + fd_{i,t} + fd_{i,t-1} + \varepsilon_{i,t} \quad (2.1)$$

Imports depend on measures of price competitiveness ($reer_{i,t}$) and domestic demand ($dd_{i,t}$). We follow Funke and Nickel (2006), Christodouloupoulou and Tkačevs (2014) and Van Limbergen and Vermeulen (2020) by also incorporating exports ($xp_{i,t}$). This should capture imports that are directly linked to exports.¹⁰ Due to vertical integration and supply chains, an increasing share of exports requires imports like intermediate goods. Our ARDL-equation becomes:

$$imp_{i,t} = c + c_i + imp_{i,t-1} + reer_{i,t} + reer_{i,t-1} + dd_{i,t} + dd_{i,t-1} + xp_{i,t} + xp_{i,t-1} + \varepsilon_{i,t} \quad (2.2)$$

Hooper et al. (2000) and Bayoumi et al. (2011) suggest that trade is non-stationary and variables may be cointegrated. This makes sense, as imports

⁹ Based on the Akaike information criterion (AIC) and the Bayesian information criterion (BIC), we decided to use 1 lag for both dependent and independent variables. We applied different combinations of lags for the variables in our 3 equations and the differences are minor. We decided therefore to keep the simplest framework.

¹⁰ While export growth may therefore be an important driver of import growth, the causality is unlikely to go the other way. We therefore do not incorporate import growth in the export growth equation (Funke and Nickel, 2006; Christodouloupoulou and Tkačevs, 2014; Van Limbergen and Vermeulen, 2020).

and exports display a strong upward trend, even as a share of GDP. We test for stationarity with the Im, Pesaran and Shin (IPS) test, because the panel is unbalanced.¹¹ The null hypothesis assumes that all series are non-stationary and this is accepted for both exports and imports (see table 2.1). We then test for cointegration by using the panel cointegration test developed by Westerlund (2007).¹² The null hypothesis of no cointegration is rejected for both exports and imports, therefore our panels are cointegrated (table 2.2). Due to the presence of non-stationarity and cointegration in a dynamic setup, we re-parameterize our ARDL into an Error Correction Model (ECM), as is common in the literature (Hooper et al.(2000); Funke and Nickel, 2006; Bayoumi et al., 2011).¹³

In our non-stationary panel the number of groups (N) is less than the number of time-series observations (T). We therefore consider three possible estimators: a traditional Dynamic Fixed Effect (DFE) estimator, the mean-group (MG) estimator (Pesaran and Smith, 1995) and the pooled mean-group (PMG) estimator (Pesaran, Shin and Smith, 1997). These methods mainly differ in their treatment of possible heterogeneity between

¹¹ The IPS test is based on Augmented Dickey-fuller (ADF) statistics averaged across groups. We also ran the t-test proposed by Pesaran (2007) for unit roots in heterogeneous panels with cross-section dependence (CIPS). The results confirm the presence of unit roots in all variables except for the trade balance.

¹² It is well-known that many studies have failed to reject the null hypothesis of no cointegration, even in cases where cointegration is strongly suggested by theory. Westerlund (2007) therefore developed panel cointegration tests based on structural rather than residual dynamics.

¹³ As the number of observations in time (T) is larger than the number of cross-sections (N), we test for cross sectional dependence with the Pesaran (2004) test. Indeed, there is significant evidence of cross-sectional dependence because, for instance, world income may be a common factor driving trade flows. We therefore demean the imports, as this takes out a large part of this common factor and therefore substantially reduces cross-sectional dependence (Funke and Nickel, 2006; Solberger, 2011).

Table 2.1. Stationarity: Im-Pesaran-Shin (IPS) panel unit root test

Variable	IPS t-bar -test			
	No trend		Trend	
	t-stat	p-value	t-stat	p-value
Exports	-1.5740	0.0577	-0.1967	0.4220
Imports	-1.5582	0.0596	2.7499	0.9970
Trade balance	-2.5179	0.0059*	-2.3083	0.0105*
REER_GDP	-1.4786	0.0696	-0.1902	0.4246
REER_CPI	-0.4121	0.3401	-0.7186	0.2362
REER_ULC	-0.6393	0.2613	0.6743	0.7499
REER_XP	-2.4576	0.0070*	-0.0719	0.4713
REER_NNTR	-8.6901	0.0000*	-14.464	0.0000*
Domestic demand	-2.5325	0.0057*	7.3861	1.0000
Foreign demand	-2.0475	0.0203*	8.4085	1.0000

Note: In the IPS-test, one lag has been imposed. * means that some panels are stationary. IPS can be used in case of unbalanced panel, but requires that there are no gaps in each individual time series. Other tests require that the panels are strongly balanced.

the countries in the sample.¹⁴ If the true model is heterogeneous, the PMG estimates are inconsistent (Blackburne and Frank, 2007). We test for the differences of the MPG and MG models with the Hausman test and conclude that the difference in the coefficients may be systemic. Hence we prefer the MG estimator over the PMG estimator. DFE models may be subject to a simultaneous equation bias due to the endogeneity of the error term and the lagged dependent variable (Baltagi, Griffin and Xiong, 2000). The Hausman test indicates that the simultaneous equation bias is minimal for our panel, allowing us to use the DFE estimator. However, as said, the presence of very different countries in the panel leads us to primarily apply

¹⁴ The DFE estimator constrains the coefficients to be equal across groups both in the short and in the long run and also imposes that the speed of adjustment coefficient is homogeneous. It therefore (implicitly) assumes a relatively high degree of homogeneity. By contrast, the MG estimator relies on estimating N separate time-series regressions for individual countries, and averaging of the coefficients over the individuals. Therefore the MG estimation makes better use of possible heterogeneity, as all the coefficients are heterogeneous both in the short and in the long run. As an intermediate case, the PMG estimator relies on a combination of pooling and averaging of coefficients, which gives heterogeneous short-run coefficients but assumes homogeneous coefficients in the long run.

the MG estimator which better deals with heterogeneity.¹⁵

Table 2.2. Cointegration: Westerlund ECM test

Equation	p-value (no trend included)			
	Gt	Ga	Pt	Pa
Exports	0.015	0.000	0.024	0.000
Imports	0.000	0.000	0.000	0.000
Trade balance	0.000	0.000	0.000	0.000

	p-value (trend included)			
	Gt	Ga	Pt	Pa
Exports	0.068*	0.002	0.187*	0.034*
Imports	0.000	0.000	0.000	0.000
Trade balance	0.000	0.000	0.000	0.000

Note: Westerlund test with constant and 1 lag included (for the whole sample). Bootstrapped 100 times. * means that the series are not cointegrated. Gt and Ga are the group-mean tests of cross-sectional units (for variance and mean). Pt and Pa are instead the statistics for the panel as a whole.

2.3.2 Model trade balance and current account balance

In our second approach, we add to the strand of literature on the determinants of current account balances in the euro area (Lane and Milesi-Ferretti, 2015; Darvas, 2015) by directly estimating equations for the trade balance and the current account balance. This model differs in a number of ways from the models based on exports and imports. First, these models can be translated more directly to the core of our research question - current account imbalances. This is because the model also takes into account other components of the current account balance than just exports and imports (Holinski et al., 2012). The model also expresses the current account as percentage of GDP, which may have a different dynamic than individual export and import flows. Second, this specification allows us to more directly include measures for the financial cycle, as the trade balance and current account balance in percentage of GDP are both stationary (see below) and

¹⁵ We have also estimated all equations with dynamic fixed effects (DFE). The results tend to be quite similar – with a few exceptions that will be mentioned – and are therefore not reported separately.

do not display a strong trend increase like exports and imports. Finally, this literature uses a broader range of potential determinants than the literature on trade equations. While this increase robustness, it also means that the results in both approaches are related, but not fully comparable.

We regress both trade balances and current account balances on a number of fundamental and a number of cyclical determinants, in line with Guillemette and Turner (2013), Lane and Milesi-Ferretti (2015), Darvas (2015), Marzinotto (2018) and Hessel (2019). Unlike some of the literature, we do not aim to determine a "fundamental value" or to quantify a possible "imbalance" for the trade or current account balances. Rather, we want to investigate to what extent the evolution of the current account balances during the EMU period are determined by cyclical factors, including price competitiveness and the financial cycle. To our knowledge, we are the first to directly include measures of the financial cycle in a model like this. We estimate the following equation:

$$ca_{i,t} = c + c_i + gdp/capita_{i,t} + \Delta pop_{i,t} + dep_{i,t} + bb_{i,t} + fd_{i,t} + reer_{i,t} + gap_{i,t} + \varepsilon_{i,t} \quad (2.3)$$

Here $ca_{i,t}$ (or $tb_{i,t}$) is the current account balance (or trade balance) in percent of GDP. As fundamentals we incorporate GDP per capita ($gdp/capita_{i,t}$) to capture convergence effects, population growth ($\Delta pop_{i,t}$) as societies with young children tend to save less, and the old-age-dependency ratio ($dep_{i,t}$) as countries with more aged populations also tend to save less. As cyclical factors, we use the budget balance ($bb_{i,t}$), and country specific foreign demand ($fd_{i,t}$) to capture differences in export destination (see section 2.4). We also incorporate price competitiveness as the real effective exchange rate ($reer_{i,t}$). Finally, we include various measures for the cycle ($gap_{i,t}$), including short-term output gaps, financial cycle measures and medium-term output gaps (section 2.4).

In line with most of the literature we estimate both equations in levels, as theory suggests that the trade balance (as percent of GDP), the current account balance (as percent of GDP), the financial cycle and price competitiveness are (close to) stationary. Indeed, the IPS-test clearly rejects the null hypothesis of non-stationarity for the trade balance.¹⁶ We estimate our model using weighted least squares (GLS) to account for possible cross-country heteroskedasticity. As endogeneity of some of the explanatory variables may be an issue, we also use GMM (Arellano Bond estimator).¹⁷ Finally we also try the ARDL/PMG-estimator, in order to take into account possible heterogeneity between countries in the sample.

2.4 Data

We estimate the model for *exports and imports* over the period from 1994:Q1 to 2012:Q4 with quarterly data for 17 euro area countries.¹⁸ The data on exports and imports are obtained from the IMF International Financial Statistics (IFS) in current USD, and converted into euros with the exchange rate EURUSD. We deflate the data using deflators from the AMECO database, interpolating the annual data to obtain them in quarterly terms.

To measure price competitiveness, we use various measures for the real effective exchange rate (REER) from the European Commission (DG ECFIN) database. The REER is measured against a broad group of 36 trading part-

¹⁶ However, it is good to recall that Error Correction Models for the trade balance are also used in the literature on the trade balance and “J-curve” effect (Gomez and Alvarez Ude, 2006). We have therefore also estimated an ECM for the trade balance, taking into account possible cointegration in the variables, albeit with a more limited number of explanatory variables and with a subsection of the financial cycle measures. The results on price competitiveness and the financial cycle are relatively comparable to those presented below. Results are available upon request.

¹⁷ We have also estimated the model with OLS. Results are comparable but less pronounced.

¹⁸ The countries are Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia and Spain. We chose 1994 as the starting year because this is the first year in which all the former Soviet countries that are now in the euro area were independent.

ners¹⁹ and deflated in different ways, using the GDP-deflator, the consumer price index (CPI), unit labour costs (ULC) for the total economy and export prices (XP). We also decompose the real effective exchange rate further into tradable and nontradable prices with the decomposition from Ruscher and Wolff (2009). The non-tradable part of the REER is calculated as the “broad component” (REER deflated with GDP-deflator) divided by the “narrow” or tradable component (REER deflated with export prices).

Our measure of foreign demand is country-specific (Chen et al., 2012) and calculated on the basis of real GDP data from the IMF International Financial Statistics (IFS) and trade data from the IMF Direction of Trade Statistics (DOTS). More specifically, to obtain demand of the rest of the world for euro area countries, we use real GDP of each trading partner weighted by the percentage of the trade of the reporter country vis-à-vis each partner.²⁰

We estimate the models for the *trade balance and current account balance* for the EMU-period using quarterly data from 1995 to 2016. We only include the countries that have joined EMU from the beginning or shortly thereafter. For this part of the analysis we use the following data. Quarterly data on trade balances and current account balances come from the IMF IFS database. GDP per capita comes from the IMF WEO database, while data on population growth and the old-age-dependency ratio come from Eurostat, and data on the budget balance come from the AMECO database. All these series are annual and hence intrapolated. The data on country-specific foreign demand are the same as in the trade regressions above. For price competitiveness we incorporate the real effective exchange rate (from the European Commission) measured in unit labour cost against a broader group of 37 countries.

¹⁹ The partners are: the EU countries (EU27) and other industrial countries (Australia, Canada, United States, Japan, Norway, New Zealand, Mexico, Switzerland, and Turkey).

²⁰ The partners are the EA17, other European countries (Sweden, Switzerland, the UK) and the main geographical areas defined by the IMF (Africa, Central and Eastern Europe, Developing Asia, Middle East, Western Hemisphere). For some countries (Malta, Cyprus, Luxembourg, Ireland and Greece) we use annual data for real GDP (the only one available for the 1990s) interpolated using cubic splines to have them in quarterly frequency.

As indicators for domestic demand and the financial cycle, we calculate various output gap measures based on real and financial variables. There is no consensus on the best way to measure the financial cycle, and our relatively simple measures are not necessarily meant as the best possibilities, but provide reasonable approximations.

We first calculate *short-term* fluctuations for both GDP and domestic demand with the bandpass or Christiano-Fitzgerald filter. We use the standard filter for short-term fluctuations between 2 and 32 quarters (8 years). For comparison, we also use the output gap calculated by the European Commission, which is widely used in policy discussions.

We then calculate various measures for the financial cycle based on financial variables. Our central measure comes from Stremmel (2015) and Alcidi (2017) and is calculated as the average from gaps in i) the credit-to-GDP ratio, ii) real credit to the non-financial sector and iii) real house prices. Each individual gap is calculated with the bandpass-filter for frequencies between 2 and 120 quarters (30 years). In addition, we also apply the three components separately.

Finally we also calculated *medium-term* fluctuations for both GDP and domestic demand with the bandpass filter for frequencies between 2 and 120 quarters (Drehmann et al., 2012). The application to domestic demand comes from Dobrescu and Salman (2011), Lendvai et al. (2011), Bénétrix and Lane (2015) and Hessel (2019). Domestic demand should provide a better measure of domestic absorption driven by financial factors than GDP. While it is not ensured that these medium-term fluctuations are actually (fully) driven by the financial cycle, Hessel (2019) shows that they did become much more strongly correlated with credit and house prices over time.

For the calculation of these cyclical measures we use the following data sources. The data on GDP and domestic demand are quarterly data taken from the OECD database. We also use the European Commission's output gaps from the AMECO database, and intrapolate these data to obtain quarterly data. The quarterly data on nominal house prices are taken from the

OECD, while quarterly data on credit to the non-financial domestic sector and the credit-to-GDP ratio are taken from the BIS. Nominal data are made real on the basis of the GDP-deflator.

2.5 Results

2.5.1 Results exports and imports

We first present the estimations for exports. As we estimate an error-correction model, we present short-run and long-run coefficients, as well as the coefficient of adjustment (Table 2.3).²¹ The results are in line with expectations and comparable to those of Bayoumi et al. (2011) and Christodouloupoulou and Tkačevs (2014). As expected, country-specific foreign demand has a positive and significant impact on exports, both in the short run and the long run. The long-run impact of foreign demand is positive and higher than one, probably because exports tend to increase as a share of GDP due to trade integration and globalization.

Price competitiveness also clearly matters, as a loss in competitiveness (an increase in the REER) consistently decreases exports. This is in line with expectations and with most of the literature. The short-run coefficients are significant in most specifications and are quite similar for different measures of the REER, as in Bayoumi et al. (2011). The only exception is the REER based on CPI-inflation, which is the index where export prices play the smallest role. The negative long-run coefficients are somewhat larger than the short-run coefficients, but they are all insignificant. A possible explanation is that the long-run coefficients are quite sensitive to the specification, because of differences in the long-run trends of exports and the REER. While the REER is thought to be mean-reverting in the long run - and thus close to stationary - exports are clearly non-stationary. This could make the long-run coefficients of the REER sensitive to how much of the trend increase in

²¹ We have also estimated all equations with dynamic fixed effects (DFE). The results are quite similar and are thus not reported separately.

Table 2.3. Export estimations with Mean Group Estimator

	(1)	(2)	(3)	(4)
short-term coefficients				
constant	5.363***	4.993***	5.212***	5.575***
Δ Foreign demand	0.227*	0.242	0.257*	0.326**
Δ REER_GDP	-0.600***			
Δ REER_CPI		-0.0299		
Δ REER_ULC			-0.625***	
Δ REER_XP				-0.573**
long-term coefficients				
Foreign demand	1.748***	1.801***	1,748***	1,393***
REER_GDP	-0.794			
REER_CPI		-0.551		
REER_ULC			-0.287	
REER_XP				-1.058
coefficient of adjustment	-0.295***	-0.289***	-0.289***	-0.300***
observations	1,220	1,220	1,220	1,220

Note: Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The dependent variable is the value of exports towards to rest of the world and in real terms. Foreign demand is the demand of the rest of the world as real GDP of each trading partner weighted by the percentage of the trade of the reporter country vis-à-vis each partner. The Reer.GDP is the Real Effective Exchange Rate taken vis-à-vis 36 partners deflated by GDP. Reer.CPI the Real Effective Exchange Rate taken vis-à-vis 36 partners deflated by CPI. Reer.ULC the Real Effective Exchange Rate taken vis-à-vis 36 partners deflated by ULC for the total economy. Reer.XP the Real Effective Exchange Rate taken vis-à-vis 36 partners deflated by export prices. All variables are in logs.

exports is captured by other variables in the model.²²

For the estimation of imports, we add non-tradable prices as a fifth measure of price competitiveness (table 2.4). We also include exports in order to capture the share of imports that is directly related to exports (Funke and Nickel, 2006; Christodoulopoulou and Tkačevs, 2014; Van Limbergen and Vermeulen, 2020).

Domestic demand has a clear and highly significant positive impact on imports, in line with expectations and Christodoulopoulou and Tkačevs

²² Indeed, the long-run coefficients vary among the specifications we tried. For example, when we estimate the export equation with the DFE-estimator, the long-run price elasticities are positive instead of negative.

Table 2.4. Import estimations with Mean Group Estimator

	(1)	(2)	(3)	(4)	(5)
short-term coefficients					
constant	-11.34***	-10.69***	-10.86***	-10.55***	-10.89***
Δ Domestic demand	0.819***	0.809***	0.812***	0.881***	0.903***
Δ Exports	0.355***	0.365***	0.375***	0.385***	0.383***
Δ REER_GDP	-0.173				
Δ REER_CPI		-0.0869			
Δ REER_ULC			0.022		
Δ REER_XP				-0.305***	
Δ REER_NNTR					0.345
long-term coefficients					
Domestic demand	0.965***	1.048***	1.048***	0.977***	0.913***
Exports	0.607***	0.579***	0.565***	0.581***	0.595***
REER_GDP	-0.101				
REER_CPI		-0.261			
REER_ULC			-0.124		
REER_XP				-0.052	
REER_NNTR					-0.005
coefficient of adjustment	-0.637***	-0.629***	-0.624***	-0.600***	-0.606***
observations	1,188	1,188	1,188	1,188	1,188

Note: Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The dependent variable is the value imports towards to rest of the world and in real terms. Domestic demand is the demand for each member state. Exports are simply the exports towards to rest of the world and in real terms. The Reer_GDP is the REER taken vis-à-vis 36 partners deflated by GDP. Reer_CPI the REER deflated by CPI. Reer_ULC the REER deflated by ULC for the total economy. Reer_XP is the REER deflated by export prices. Reer_NNTR is the REER deflated by non-tradable prices calculated Reer_GDP/Reer_XP. All variables are in logs.

(2014). The short-run elasticity is somewhat below one, while the long-run coefficient is around one. This underlines that domestic demand is indeed a clear driver of import growth. Exports also have a significantly positive impact on imports, underlying that an important share of imports can indeed be directly related to exports (see also Christodoulopoulou and Tkačevs, 2014). The impact of price competitiveness on imports is more difficult to grasp. The coefficients for the REER are generally insignificant, both in the short and in the long run. In addition, the coefficient has the wrong sign (negative) in two short-run cases and all long-run cases. Although this is not in line with expectations, Christodoulopoulou and Tkačevs (2014) find

similar results. This implies that imports are driven more by domestic demand than by price competitiveness. That said, the results may not be fully robust, as price elasticities are sensitive to the specification due to trends in imports.²³

We then want to get a feel for the relative importance of price competitiveness, foreign demand and domestic demand for exports and imports. We start by calculating average export growth for the period 1999-2007 and the parts that can be explained by price competitiveness and foreign demand. To do this, we multiply the average changes in the GDP-based REER and foreign demand growth by their long-term coefficients (Figure 2.3a, based on the coefficients from Table 2.3).

The differences in export growth before the crisis are quite substantial. Export growth is relatively high in the core countries of the euro area (Germany, Finland, Austria and the Netherlands), while France and the countries in the periphery display lower export growth.²⁴ These differences can indeed be partly traced back to price competitiveness. While the decrease in the REER has contributed positively to export growth in Germany, it has decreased exports in many other countries, including Spain, Ireland and to a lesser extent Portugal and Italy.²⁵ The variation of the contribution of country-specific foreign demand to export performance is however much higher. Foreign demand has contributed substantially to export growth in core countries like Germany, Belgium and France, while it was relatively

²³ We also estimated an alternative specification, using domestic credit as a proxy for the financial cycle (these results are available upon request). The effect of price competitiveness is clearer in this specification, although the results are not fully robust. The long-run coefficients for the REER are positive, and in three cases highly significant. Interesting is that the coefficient of the REER based on export prices is the smallest, while the coefficient of the REER based on non-tradable prices is the highest. This suggests that import performance is more related to non-tradable prices, as suggested by Ruscher and Wolff (2009). We also estimated the import equation with both credit and domestic demand. The coefficients are very similar to those in table 2.4.

²⁴ Slovakia, Estonia and Slovenia show the highest exports growth, probably due to convergence, their transition towards EMU-membership and the outsourcing of (stages of) production by old member states.

²⁵ Estonia and Slovakia also have a large negative contribution, but their real exchange rate may have appreciated due to convergence (Balassa-Samuelson effect).

Figure 2.3. Contribution price competitiveness, foreign demand and domestic demand to trade flows

low in peripheral countries like Greece, Spain and Italy. This confirms that the destination and composition of foreign demand matters substantially (Chen et al., 2012; Wierds et al., 2014).

We then turn to import growth in the period 1999-2007 and the part of it explained by competitiveness and domestic demand (Figure 2.3b, based on the coefficients from Table 2.4). As expected from our estimations, price competitiveness has almost no influence on import growth. Domestic demand seems the key driver of import growth, and domestic demand also displays large differences between countries. Apart from the converging countries, the highest contribution of domestic demand is in parts of the periphery: Ireland, Spain, Cyprus and Greece. These countries indeed experienced a credit and house price boom (Shambaugh, 2012). By contrast, domestic demand had a much smaller contribution in core countries and especially Germany.²⁶

2.5.2 Results trade balance and current account balance

We now present estimates for the trade balance and the current account balance. The results for price competitiveness and the financial cycle are remarkably comparable across estimation methods (GLS, GMM and PMG estimators) and across the two types of balances (current account and trade balance). We therefore describe overall conclusions based on all estimations, rather than separate results per specification. We illustrate these conclusions with the GLS estimation for the current account balance as the central specification (table 2.5), but the specification for the trade balance (table 2.6) and the other specifications (tables 2.7 to 2.10 in the appendix) yield comparable

²⁶ The contribution of domestic demand was also low in the peripheral countries Portugal and Italy. Rather than a credit driven domestic demand boom, these countries experienced a gradual decline in potential growth due to structural weaknesses, masked by favourable global financing conditions (Kang and Shambaugh, 2013; Reis, 2013).

results.²⁷ In the benchmark estimation all coefficients are significant, while most have the expected sign.²⁸

A number of conclusions can be drawn. First, it is very clear that price competitiveness and the financial cycle *both* play a role in the evolution of trade and current account imbalances. Price competitiveness is statistically significant in most specifications, and has the expected negative coefficient: an increase in relative prices lowers the current account balance. All output gaps measures are also (highly) significant and have the expected negative coefficient: an increase in the output gap worsens the current account balance. This holds for the short-term output gaps (columns 1-3 in table 2.5), for the financial cycle and its subcomponents (columns 4-7) and for the medium-term output gaps (columns 8 and 9).²⁹ These results are qualitatively in line with the results from the import and export equations, where price competitiveness and domestic demand were both important (even though coefficients are not directly comparable).

²⁷ Nevertheless, a few differences between the various estimations are worth mentioning. First, the coefficients for the financial cycle and especially price competitiveness tend to be larger for the current account balance than for the trade balance. Second, both estimations in GMM tend to lead to lower coefficients for price competitiveness and a lower significance overall. Third, something similar is visible for the ARDL/PMG estimations, but less pronounced. Finally, while the coefficients for price competitiveness and the financial cycle appear to be very robust, some of the coefficients of the other variables tend to vary more widely across specifications (even in sign).

²⁸ There are two exceptions. First, the coefficient for the old-age-dependency ratio is positive, which suggests that in contrast with expectations, countries with a more aged population tend to save more, not less. Second, the coefficient for country-specific external demand is negative, which suggest that countries with the highest external demand growth have lower current account balances.

²⁹ The differences in the coefficients for the various output gaps should not be mistaken as an indicator of their importance for the current account imbalances, as these gap measures differ substantially in amplitude.

Table 2.5. Regressions current account balances - GLS

	business cycle			financial cycle				sensitivity analysis						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
constant	-35.6**	-35.7**	-67.3**	-50.2**	-87.4**	-38.4**	-71.1**	-121.4**	-147.3**	-38.6**	-61.7**	-94.5**	-44.1**	-53.6**
foreign demand	-0.10**	-0.11**	-0.14**	-0.09**	-0.13**	-0.09**	-0.10**	-0.18**	-0.19**	-0.06**	-0.09**	-0.12**	-0.08**	-0.08**
budget balance	0.07**	0.08**	0.16**	0.12**	-0.06**	-0.11**	0.02	0.25**	0.30**	0.04	0.09**	0.20**	0.01	0.04
price competitiveness	-0.13**	-0.13**	-0.18**	-0.06**	-0.09**	-0.12**	-0.05**	-0.11**	-0.06**	-0.07**	-0.07**	-0.06**	-0.05**	-0.06**
GDP gap	-0.14**													
DD gap (short-term)		-0.25**								-0.21**				
EC gap (short-term)			-0.43**											
house price gap				-0.07**										
credit gap					-0.17**									
credit-to-GDP gap						-0.15**								
financial cycle							-0.19**	-0.37**	-0.43**	-0.17**	-0.14**	-0.08**	-0.14**	-0.17**
GDP gap (medium-term)												-0.26**	0.13**	0.02**
DD gap (medium-term)														
capital inflows														
private capital inflows														
GDP per capita	0.04**	0.04**	0.09**	0.05**	0.09**	0.04**	0.07**	0.14**	0.16**	0.04**	0.19**	0.10**	0.05**	0.06**
population growth	-2.83**	-2.84**	-1.80**	-2.23**	-1.49**	-2.16**	-1.64**	-1.64**	-0.65**	-1.49**	-2.90**	-0.91**	-1.74**	-1.63**
old-age dependency	0.75**	0.73**	0.68**	0.60**	0.79**	0.73**	0.57**	0.72**	0.65**	0.41**	0.55**	0.53**	0.52**	0.48**
R ²	0.76	0.77	0.80	0.79	0.84	0.81	0.83	0.83	0.86	0.83	0.83	0.85	0.85	0.83
Durbin-watson	0.44	0.43	0.46	0.47	0.50	0.49	0.55	0.47	0.53	0.55	0.55	0.55	0.68	0.60
observations	903	903	903	877	903	903	877	903	903	796	796	796	784	784

Note: * is 5% significance, ** is 1% significance. Panel regressions with quarterly data for 11 EMU countries the period 1995-2016, using Weighted Least Squares (GLS) with country fixed effects and white robust standard errors.

Note: * is 5% significance, ** is 1% significance. Panel regressions with quarterly data for 11 EMU countries the period 1995-2016, using Weighted Least Squares (GLS) with country fixed effects and white robust standard errors.

Table 2.6. Regressions trade balances - GLS

	business cycle			financial cycle			sensitivity analysis							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
foreign demand	-122.8**	-117.9**	-174.3**	-127.4**	-152.1**	-127.9**	-143.5**	-186.1**	-199.9**	-87.8**	-149.0**	-182.6**	-111.7**	-96.2**
budget balance	-0.19**	-0.18**	-0.25**	-0.17**	-0.19**	-0.18**	-0.18**	-0.23**	-0.23**	-0.14**	-0.21**	-0.26**	-0.15**	-0.15**
price competitiveness	-0.05	-0.04	0.11**	0.07*	-0.04	-0.06*	0.03	0.14**	0.19**	-0.03	0.11**	0.19**	-0.04	-0.03
	-0.08**	-0.08**	-0.13**	0.01	-0.05**	-0.07**	-0.01	-0.04**	-0.01	-0.04**	-0.05**	-0.02	-0.03	-0.03*
GDP gap	-0.04									-0.20**				
DD gap (short-term)		-0.22**												
EC gap (short-term)			-0.57**											
house price gap				-0.05**										
credit gap					-0.07**									
credit-to-GDP gap						-0.05**								
financial cycle							-0.09**			-0.07**	0.01	0.08**	-0.04**	-0.07**
GDP gap (medium-term)								-0.30**			-0.25**	-0.42**	0.13**	0.03**
DD gap (medium-term)									-0.36**					
capital inflows														
private capital inflows														
GDP per capita	0.13**	0.13**	0.19**	0.13**	0.16**	0.14**	0.15**	0.20**	0.22**	0.16**	0.19**	0.20**	0.09**	0.10**
population growth	-3.30**	-3.28**	-1.85**	-3.32**	-3.25**	-3.33**	-3.44**	-2.84**	-1.94**	-2.64**	-2.90**	-1.97**	-2.74**	-2.73**
old-age dependency	0.91**	0.86**	0.82**	0.68**	0.74**	0.81**	0.71**	0.69**	0.53**	0.85**	0.55**	0.88**	0.77**	0.74**
R ²	0.87	0.87	0.90	0.89	0.89	0.88	0.89	0.90	0.91	0.87	0.90	0.89	0.87	0.86
Durbin-watson	0.38	0.35	0.48	0.42	0.41	0.39	0.44	0.44	0.48	0.43	0.53	0.47	0.53	0.45
observations	891	891	891	865	891	891	865	891	891	784	784	784	784	784

Note: * is 5% significance, ** is 1% significance. Panel regressions with quarterly data for 11 EMU countries the period 1995-2016, using Weighted Least Squares (GLS) with country fixed effects and white robust standard errors.

Note: * is 5% significance, ** is 1% significance. Panel regressions with quarterly data for 11 EMU countries the period 1995-2016, using Weighted Least Squares (GLS) with country fixed effects and white robust standard errors.

Second, inclusion of the financial cycle tends to lower the coefficients for price competitiveness, and in some cases also their significance. When the short-term output gaps are included, the coefficients for price competitiveness are fairly large (columns 1-3). However, when we include the financial cycle or medium-term fluctuations instead, the coefficients decrease, in some cases by more than half (columns 4-9). This suggests that taking into account financial variables and the financial cycle matters substantially for the impact of price competitiveness. It also suggest that the financial cycle and medium-term fluctuations more generally are better explanations of the evolution of current account balances than short-term fluctuations.

We then perform several sensitivity analyses. First, we compare the influence of the financial cycle to that of the normal *short-term* business cycle, by including both gaps in the estimation together (column 10 in table 2.5). The coefficients for both gaps remain very similar as in the regressions where they were included separately. We conclude that the financial cycle is largely unrelated to the short-term fluctuations in GDP and domestic demand. Second, we also compare the influence of the financial cycle to that of *medium-term* fluctuations in GDP and domestic demand (columns 11 and 12). Including both gaps together clearly reduces their coefficients compared to the regressions where they were included separately. We conclude that the financial cycle and medium-term fluctuations in GDP and domestic demand evolve relatively similar and are therefore related. This confirms results by Hessel (2019), who finds that medium-term fluctuations have become strongly correlated with credit and house prices.

As a final robustness check, we look at the importance of a domestic component and an external component of the financial cycle. We add a measure of capital inflows proxied by the capital account of the balance of payments (column 13). We also use this capital account corrected for official flows such as ESM support and changes in target2 balances, to better measure private capital flows (column 14). Both measures are significant with the expected (positive) sign, and both reduce the coefficient for the domestic

financial cycle. This suggests that the financial cycle in euro area countries has a domestic and an external component. At the same time, we cannot draw strong conclusions on their relative importance, as both are strongly interrelated.

Finally, we again try to see what these results mean in practice for the relative importance of price competitiveness and the financial cycle for the development of current account balances. We plot the actual changes of current account balances of euro area countries in the period 1999-2007 when imbalances were building (figure 2.4) and in the period 2008-2015 when imbalances were corrected (figure 2.5). We compare this with the part of these changes explained by price competitiveness and the cycle in three models: the model with short-term fluctuations in domestic demand (panels "a" in both figures), the model with the financial cycle (panels "b" in both figures) and the model with medium-term fluctuations in domestic demand (panels "c"). The contributions of price competitiveness and the cycle are calculated by multiplying the changes in these variables by their coefficients from the respective GLS-estimations.

A number of findings emerges. First, short-term fluctuations explain very little of the changes in current account balances in the euro area. In this model, the changes are almost fully explained by changes in price competitiveness (figure 2.4a and 2.5a). Second, this picture clearly changes when we include the financial cycle or medium-term fluctuations instead. In these models, changes in price competitiveness remain important, but the largest part of the changes in current accounts is explained either by the financial cycle (figure 2.4b and 2.5b) or by medium-term fluctuations in GDP (figure 2.4c and 2.5c). Third, the models with the financial cycle and the medium-term fluctuations in domestic demand lead to highly comparable results. These results qualitatively confirm the results from our export and import equations, where it emerged that differences in foreign demand and domestic demand were more important than differences in price competitiveness.

Figure 2.4. Contribution competitiveness and financial cycle to current account changes, 1999-2007

Figure 2.5. Contribution competitiveness and financial cycle to current account changes, 2008-2015

We conclude that the financial cycle is an important factor in the evolution of current account balances in the euro area. Taking into account financial variables and the financial cycle is therefore very important to get a clear impression on the role of price competitiveness. Our analysis shows that competitiveness and the financial cycle have both affected current account balances, but that the influence of the financial cycle is clearly larger. Moreover, the financial cycle and medium-term fluctuations more generally are better explanations of the evolution of current account balances in the euro area than short-term fluctuations. Finally, the results for our model for the current account are qualitatively comparable to the results for our models for exports and imports. Because both approaches use different methodologies and different ranges of explanatory variables, this underlines the robustness of our results.

2.6 Conclusions and policy implications

We have investigated the relative importance of price competitiveness and domestic demand as drivers of the current account imbalances in the euro area. We conclude that competitiveness has a clear influence, but that domestic demand booms driven by the financial cycle have been more important. This is not always realized in the policy debate and the literature. This result is confirmed using two different methodologies with different ranges of explanatory variables. From our estimated trade equations, it emerges that the influence of price competitiveness is clearest on export performance. At the same time, the influence of external demand on differences in exports is larger. This confirms findings in the recent literature that the destination and composition of exports matters substantially. The influence of competitiveness on import performance is more difficult to find: domestic demand is by far the most important driver of imports.

This conclusion is confirmed by the estimations for trade and current account balances. We find that including the financial cycle or medium-term demand fluctuations in these estimations clearly reduces the importance of

price competitiveness. We also find that differences in domestic demand and the financial cycle are a more important determinant of the evolution of trade balances and current account balances than differences in price competitiveness. This holds both for the buildup of these imbalances before the crisis (the period 1999-2007) and for their correction afterwards (2008-2016). Moreover, financial cycles and medium-term fluctuations explain the movements in trade and current account balances much better than normal business cycles.

Our findings have several policy implications. First, current account imbalances caused by unsustainable demand booms due to the financial cycle will partly correct themselves without an immediate adjustment in relative prices. A turn in the financial cycle could lead to a long-lasting correction in domestic demand, as banks, households and companies deleverage to reduce debt. This correction will happen largely irrespective of the movements of the real effective exchange rate in this period. A change in relative prices or an EMU-exit to devalue the exchange rate would only have a small effect on this domestic process of deleveraging.

Second, to detect imbalances in the euro area, it is not sufficient to only monitor price competitiveness. More emphasis on the financial cycle and on credit and house price growth is just as important. More attention should also be paid to the development of non-tradable prices. Finally, in addition to the existing European mechanisms to foster structural reforms, like Europe 2020 and the macroeconomic imbalance procedure (MIP), a further strengthening of financial and macroprudential policies in the euro area would deserve priority. Relevant measures include cleaning up bank balance sheets proactively and a more active use of macroprudential measures like the countercyclical capital buffers (CCyB) and borrower based measures like loan-to-value (LTV) limits. Strengthening the European macroprudential policy framework could also be considered.

Appendix A. Additional regression results

Table 2.7. Regressions current account balances - GMM

	business cycle			financial cycle				sensitivity analysis					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
foreign demand	-0.16	-0.08	-0.05	-0.20*	-0.04	-0.03	-0.08	-0.21	-0.13	-0.02	-0.08	-0.08	-0.07
budget balance	0.11	0.09	0.22*	0.15*	-0.12	-0.07	-0.06	0.23	0.23*	-0.06	0.04	-0.06	-0.09
price competitiveness	-0.02	0.01	-0.04	0.05	-0.08*	-0.06*	-0.01	-0.02	-0.00	-0.04**	-0.02	-0.01	-0.02
GDP gap	0.03												
DD gap (short-term)		-0.11**								-0.12**			
EC gap (short-term)			-0.25**										
house price gap				-0.03									
credit gap					-0.19**								
credit-to-GDP gap						-0.14**							
financial cycle							-0.24**			-0.23**	-0.15	-0.24**	-0.25**
GDP gap (medium-term)								-0.35**					
DD gap (medium-term)									-0.39**		-0.19**		
capital inflows													
private capital inflows													0.01
GDP per capita	-0.01	-0.08	-0.07	0.06	0.06	-0.03	0.07*	0.08	0.10	0.04	0.08	0.07*	0.07
population growth	-1.15	-0.18	-0.46	-3.61*	-0.72	-1.55*	-0.78*	0.18	0.47	-0.49	-0.66	-0.78*	-0.12
old-age dependency	2.01**	1.74**	1.31*	1.53**	0.39	0.88**	0.49	1.02*	0.56*	0.19	0.24	0.49	0.43
observations	892	892	892	866	892	892	866	892	880	774	774	774	774

Note: * is 5% significance, ** is 1% significance. Panel regressions with quarterly data for 11 EMU countries the period 1995-2016, using GMM.

Table 2.8. Regressions current account balances - ARDL/PMG

	business cycle			financial cycle				sensitivity analysis						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
foreign demand	-0.05**	-0.05**	-0.04**	0.00	-0.05**	-0.05**	-0.02**	-0.03*	-0.23**	-0.03**		0.00	-0.02	-0.02**
budget balance	0.36**	0.30**	0.40**	0.30**	0.20**	0.13**	0.21**	0.51**	0.19**	0.33**		0.46**	0.23**	0.22**
price competitiveness	-0.05*	-0.05**	-0.09**	0.03	-0.05*	-0.04	-0.02	-0.08**	-0.06	-0.02		-0.04*	-0.02	-0.02
GDP gap	-0.37**													
DD gap (short-term)		-0.34**								-0.30**				
EC gap (short-term)			-0.36**											
house price gap				-0.08**										
credit gap					-0.09**									
credit-to-GDP gap						-0.11**								
financial cycle							-0.17**			-0.11**	-0.13**	-0.08**	-0.18**	-0.16**
GDP gap (medium-term)								-0.38**	-0.47**		-0.18**	-0.35**		
DD gap (medium-term)													0.03	0.04**
capital inflows														
private capital inflows														
GDP per capita	0.01**	0.01**	0.01**	0.01	0.01**	0.01**	0.01**	0.01**	0.22**	0.01**	0.01**	0.01**	0.01*	0.01*
population growth	-2.87**	-2.62**	-2.35**	-3.4**	-1.80**	-1.89**	-2.58**	-2.31**	-1.94**	-2.77**	-2.70**	-2.29**	-2.52**	-2.54**
old-age dependency	0.20*	0.20*	0.15*	-0.23	0.20*	0.25**	-0.02	0.03	1.09**	-0.02	-0.08	-0.19	-0.01**	0.05
observations	892	892	892	866	892	892	866	892	892	786	866	866	774	774

Note: * is 5% significance, ** is 1% significance. Panel regressions with quarterly data for 11 EMU countries the period 1995-2016, using ARDL/PMG.

Table 2.9. Regressions trade balances - GMM

	business cycle			financial cycle				sensitivity analysis					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
foreign demand	-0.22	-0.10	-0.13	-0.19	-0.11	-0.15	-0.13	-0.10	-0.21	-0.07**	-0.14*	-0.10	-0.11
budget balance	-0.05	-0.04	0.09	0.02	-0.16**	-0.15**	-0.13	0.10	0.10	-0.16**	-0.01	-0.20**	-0.19**
price competitiveness	-0.03	-0.06	-0.08	-0.00	-0.11**	-0.10**	-0.06	-0.09	-0.06	-0.09**	-0.07	-0.08	-0.08
GDP gap	0.08												
DD gap (short-term)		-0.15**								-0.15**			
EC gap (short-term)			-0.29**										
house price gap				-0.06									
credit gap					-0.12**								
credit-to-GDP gap						-0.10**							
financial cycle							-0.18**						
GDP gap (medium-term)								-0.38**					
DD gap (medium-term)									-0.41**				
capital inflows											-0.33**		
private capital inflows											0.05*		0.01*
GDP per capita	0.06	-0.02	0.02	0.12	0.12	0.10	0.14*	0.09	0.15**	0.09	0.21**	0.12*	0.12
population growth	0.01	0.64	0.53	-2.67	-2.15*	-2.34*	-2.19*	1.68**	1.02	-1.61*	-0.31	-1.14	-1.13
old-age dependency	2.12**	1.62**	1.43**	1.04	0.48	1.08**	0.38	0.55	0.12	0.23	-0.27	0.35**	0.38
observations	880	880	880	854	880	880	854	880	880	774	774	774	774

Note: * is 5% significance, ** is 1% significance. Panel regressions with quarterly data for 11 EMU countries the period 1995-2016, using GMM.

Table 2.10. Regressions trade balances - ARDL/PMG

	business cycle			financial cycle				sensitivity analysis						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
foreign demand	-0.03	0.13**	-0.07**	0.12**	0.15**	0.14**	0.14**	0.11**	-0.23**	0.14**	0.21**	-0.05**	0.12**	0.12**
budget balance	0.27**	0.13	0.64**	0.45*	0.20**	-0.02	0.21**	0.51**	0.19**	0.22**	0.11**	0.73**	0.20**	0.20**
price competitiveness	-0.12**	-0.13**	-0.06	-0.04	-0.07**	-0.18**	-0.03	-0.06	-0.01	-0.13**	-0.13**	0.01	-0.06	-0.07*
GDP gap	-0.11													
DD gap (short-term)		-0.22*								-0.23**				
EC gap (short-term)			-0.60**											
house price gap				-0.21**										
credit gap					-0.19**									
credit-to-GDP gap						-0.22**								
financial cycle							-0.25**			-0.17**	0.01	0.05	-0.20**	-0.22**
GDP gap (medium-term)								-0.36**			-0.25**	-0.46**		
DD gap (medium-term)												0.07*		
capital inflows														
private capital inflows													0.03**	
GDP per capita	0.04**	0.02**	0.03**	0.01**	0.01**	0.03**	0.01	0.02**	0.22**	0.02**	0.19**	0.01**	0.02**	0.02**
population growth	-1.97**	-0.85	-0.80	-0.45	-0.55	-1.48**	0.02	-2.40**	-1.94**	-0.08**	-2.90**	-1.51**	-0.92**	-1.01
old-age dependency	-0.89**	0.88**	-0.39*	-0.99**	0.85**	-1.10**	-0.74**	0.69**	1.09**	-1.03**	0.55**	-0.15	-1.14**	-1.15**
observations	880	880	880	854	880	880	854	891	880	774	774	774	774	774

Chapter 3

Medium-term Asymmetric Fluctuations and EMU as an Optimum Currency Area*

3.1 Introduction

A central part of the theory of optimum currency areas (OCAs) is the occurrence of asymmetric shocks or fluctuations in a monetary union. While the original OCA-theory did not specify the nature of these fluctuations, the application of this theory to the Economic and Monetary Union (EMU) often focused on *short-term* fluctuations, especially business cycle fluctuations with a frequency of up to 8 years.¹ A key question was how the symmetry of short-term fluctuations would evolve once EMU had been established. An optimistic view was that the single currency would increase trade integration and thereby endogenously increase the symmetry of cycles (Frankel

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¹ Or as an alternative, short-term underlying shocks from VAR-analyses (Bayoumi and Eichengreen, 1993; 2017).

and Rose, 1998). De Haan et al. (2008) provide an overview of the empirical literature on business cycle synchronization.

In the almost 20 years since the start of EMU, short-term fluctuations have been surprisingly symmetric, even during the sovereign debt crisis (figure 3.1). This is confirmed in several recent studies, and has led to benign views on the functioning of EMU as an optimum currency area. Van Beers et al. (2014) conclude that: *"co-movement of real GDP per capita among EMU countries [...] is on average slightly stronger than that among US states"*. Gächter and Riedl (2014) conclude that: *"the adoption of the euro has significantly increased the correlation of member countries' business cycles [...]. Thus, [...] a country is more likely to satisfy the criteria for entry into a currency union ex post rather than ex ante"*. Campos and Macchiarelli (2016) state that their analysis: *"provides renewed support for the endogenous OCA hypothesis. Moreover, [...] there might be less wrong with the euro than commonly thought"*.

Figure 3.1. Short-term output gaps EMU countries

Note: short-term output gaps calculated with the bandpass (Christiano-Fitzgerald) filter for fluctuations between 2 and 32 quarters (8 years). Averages calculated with GDP weights.

It remains an important puzzle, however, how these benign views can be reconciled with the sovereign debt crisis, that hit the euro area severely and is sometimes seen as *"the mother of all asymmetric shocks"* (Krugman, 2012, p. 444). The euro crisis was related to the buildup and correction of several

large and long-lasting divergences: in the growth of credit and house prices, in price competitiveness, in current account balances and in budget deficits (De Haan et al., 2016). It seems unrealistic that these divergences have left no mark on economic fluctuations. Moreover, it is well established that some EMU countries have experienced much deeper and longer recessions after the crisis than others. For example, cumulative growth between 2009 and 2013 was +3.4% in Germany but -7.8% in Italy, -8.0% in Portugal and -9.2% in Spain.

In this paper, we explore a possible solution to this puzzle. Our idea is that the sovereign debt crisis and its divergences *did* lead to asymmetric fluctuations, but that they were *longer lasting* than normal business cycles. These longer fluctuations cannot be captured with common methods to identify business cycles, which are often directed at short-term frequencies. In these common methods, the longer-term fluctuations therefore do not end up in the fluctuations, but in the underlying trends. Two indications support this hypothesis. First, the recent literature confirms that crises and macroeconomic imbalances affect trend growth. Potential GDP has declined in many countries after the financial crisis, for instance due to deleveraging and hysteresis (European Commission, 2014; Ball, 2014; IMF, 2015; Bayoumi and Eichengreen, 2017). Fluctuations in trend growth are linked directly to the build-up and unwinding of macro-financial imbalances, like credit and house price bubbles (Borio et al., 2013; Berger et al., 2015) or growing current account deficits and losses in price competitiveness (Alberola et al., 2013; Ollivaud and Turner, 2014). Second, trend growth rates in the euro area indeed display surprisingly large and persistent asymmetric fluctuations (figure 3.2). While trend growth was stable in countries like Germany and Austria, it fluctuated strongly in countries like Ireland, Spain and Greece.

Our idea is therefore that around the crisis, EMU member states may have experienced asymmetric *medium-term* fluctuations, rather than short-term fluctuations. We build on the literature on medium-term fluctuations, including Blanchard (1997), Caballero and Hammour (1998), Solow (2000),

Figure 3.2. Trend growth rates EMU countries

Note: growth rates of the underlying trend in GDP matching the short-term output gaps calculated with the bandpass (Christiano-Fitzgerald) filter for fluctuations between 2 and 32 quarters (8 years). Averages calculated with GDP weights.

Comin and Gertler (2006), Drehmann et al. (2012) and De Winter et al. (2017). The attention for medium-term cycles is growing, due to the so-called *financial cycle*, a medium-term fluctuation driven by credit and house prices (Drehmann et al., 2010; Borio, 2012b). However, medium-term fluctuations can also be driven by real factors like productivity (Blanchard, 1997; Comin and Gertler, 2006). We compute measures of medium-term fluctuations using statistical filters with lower frequencies derived from this literature.

Our central hypothesis is that looking at medium-term fluctuations instead of short-term fluctuations leads to a less benign view on the functioning of EMU as an optimum currency area, that is more in line with the experience of the debt crisis. To confirm this hypothesis, we first need to establish that medium-term fluctuations in the euro area are less symmetric than short-term fluctuations. In addition, we also need to establish that these asymmetric medium-term fluctuations are relevant for the functioning of EMU as an optimal currency area, and do not reflect divergences in the "genuine" growth potential of member states that may be relatively harmless.

Our analysis has three parts. In the first part, we compare the symmetry

of medium-term fluctuations in the euro area to that of short-term fluctuations. Part of this has also been done by De Grauwe and Yi (2016) and Alcidi (2017), but we use longer time-series since 1970. In addition, we are to our knowledge the first to make a comparison with medium-term fluctuations in US states and regions. Furthermore, we follow Mink et al. (2012) by using separate measures for symmetry in the *phase* of fluctuations and symmetry in the *amplitude* of fluctuations. Differences in the amplitude of fluctuations are also relevant in a monetary union, for instance because the single monetary policy cannot take them into account (Mink et al., 2012; Belke et al., 2016).

The second part of the analysis tries to relate medium-term fluctuations to their potential drivers. We look at the relative role of *real* drivers, in particular productivity, and *financial* drivers, in particular credit and house prices. The literature suggests that especially medium-term fluctuations driven by financial factors cause macroeconomic imbalances and crises (Drehmann et al., 2012; Borio, 2012b). The relative importance of financial drivers should therefore give an indication on the harmfulness of medium-term fluctuations and on their relevance for the functioning of EMU.

Third, we investigate if the buildup and correction of imbalances in price competitiveness, current accounts and budget deficits in EMU can be related to medium-term rather than short-term fluctuations. According to the literature, these imbalances are at least partly related to medium-term oriented financial cycles (De Haan et al., 2016). We estimate panel regressions for these imbalances that include measures of the cycle, and compare the (partial) explanatory power of medium-term and short-term fluctuations. A higher explanatory power of medium-term fluctuations would be a further indication on their relevance for the functioning of EMU.

We present five key findings. First, medium-term fluctuations are much larger and less symmetric than short-term fluctuations. Second, medium-term fluctuations became larger and less symmetric over time, while short-term fluctuations became smaller and more symmetric. Third, medium-term fluctuations in EMU are less symmetric than in the US, while short-term

fluctuations are more symmetric. Fourth, we find that medium-term fluctuations in the euro area have become more strongly correlated with financial variables like credit and house prices, and less strongly correlated with real variables like productivity. Finally, imbalances in competitiveness, current accounts and budget deficits in the euro area are more closely related to medium-term fluctuations than to short-term fluctuations.

We conclude that the medium-term has become a relevant dimension for the functioning of EMU as an optimum currency area. This is due to the increasing role of financial factors and financial cycles, that has increased the asymmetry of medium-term term fluctuations, mainly due to larger differences in the amplitude of fluctuations. Financial factors have also made medium-term fluctuations more harmful, increasing the risk of macro-financial imbalances and crises. Overall, the focus on medium-term fluctuations therefore leads to less benign views on the functioning of EMU as an optimum currency area, that are more in line with the sovereign debt crisis. It also casts doubt on the idea that EMU has endogenously become closer to an optimum currency area.

The paper is structured as follows. Section 3.2 reviews the literature on medium-term fluctuations and their potential evolution in a monetary union. Section 3.3 describes the methodology. Section 3.4 describes the data, while section 3.5 presents the results. Section 3.6 concludes.

3.2 Literature

3.2.1 Medium-term fluctuations

It is common to see cycles as relatively short-term fluctuations around a stable trend (figure 3.3, left panel). These fluctuations result from shocks and their propagation, which are often assumed to peter out in a number of years. Growth then returns to its long-run trend, which may vary due to changes in demographics or technical progress, but which is essentially stable. Yet the possibility of medium-term fluctuations is not new. It dates

back to Kuznets (1930) and has been the subject of a small number of papers like Blanchard (1997), Caballero and Hammour (1998), Solow (2000), Comin and Gertler (2006) and Drehman et al. (2012). The idea has gained considerable traction after the financial crisis. It is assumed that in addition to the short-term fluctuations and the long-term trend, countries may also experience longer lasting fluctuations (figure 3.3, right panel). In the literature, these medium-term fluctuations result from propagation mechanisms that start later, move more slowly and are more persistent. They are usually related to the (endogenous) buildup and correction of certain imbalances. Medium-term fluctuations may lead to longer periods of strong and robust growth (like the 1960s and 1990s), followed by longer periods of low and vulnerable growth (like the late 1970s and early 1980s).

Figure 3.3. Stylized representation of short-term and medium-term fluctuations in GDP

Note: stylized representation, does not necessarily reflect developments in particular EMU countries.

There is no consensus on the underlying causes of medium-term fluctuations. Blanchard (1997), Caballero and Hammond (1998) and Comin and Gertler (2006) emphasize the role of *real* economic factors. They point at wage-markup shocks, like the gradual increase in labour income shares in the 1970s (Blanchard, 1997; Caballero and Hammour, 1998). This development triggers no adjustment in the short term, when capital is "fixed", but

eventually lead to medium-term adjustment in the form of substitution from labour to capital (Blanchard, 1997) or innovation and endogenous technological progress (Comin and Gertler, 2006). The implication is that medium-term fluctuations in GDP are correlated with fluctuations in labour productivity and total factor productivity.

By contrast, Drehman et al. (2012) emphasize the role of *financial* factors. Their idea is that the financial accelerator amplifies and prolongs economic fluctuations via movements in asset prices, credit and private debt. Borio (2012b) for instance shows that financial deregulation may lead to a credit- and house price boom that eventually self-corrects and triggers a longer period of declining house prices and deleveraging. This is closely related to the so-called financial cycle, which is thought to have a higher amplitude and longer duration than normal business cycles, and which has become more important due to financial liberalization (Borio, 2012b). So far, financial cycles have mainly been derived from financial variables only (Galati et al., 2016). Several papers find some relation with fluctuations in GDP (Drehman et al., 2012), while a few studies find more systematic relationships.² Medium-term GDP fluctuations are correlated with fluctuations in credit and house prices (Borio, 2012b).

There is no consensus either on the frequency of medium-term fluctuations. Comin and Gertler (2006) look at fluctuations of up to 50 years in their empirical analysis, while Drehman et al. (2012) look at fluctuations of up to 30 years. Borio (2012b) claims that the financial cycle would have a duration of 16-20 years. The lack of consensus is understandable. In practice, the distinction between short-term fluctuations, medium-term fluctuations and trends is uncertain, also because these variables are unobservable. It may be hard to separate short- and medium-term fluctuations, that are often driven by the same shocks (Comin and Gertler, 2006). Likewise, genuine increases in trend growth, due to for instance convergence or higher labour force participation, may be hard to distinguish from unsustainable

² See primarily Borio et al. (2013; 2014) and Berger et al. (2015). However, these papers are not necessarily directed at medium-term frequencies.

credit booms. Statistical filters cannot provide full clarity either, as they often require assumptions on the frequency of fluctuations. Through the lens of a short-term statistical filter, medium-term fluctuations result in relatively small and stable cycles accompanied by large fluctuations in trend growth (figure 3.4, left panel). Applying a statistical filter with a medium-term frequency leads to a more stable trend and to much larger and longer lasting fluctuations (figure 3.4, right panel). Therefore, choices will to some extent remain subject to debate, as there is no absolute certainty. However, De Winter et al. (2017) have tried to identify the frequency medium-term fluctuations without making prior assumptions using spectral density analysis. They conclude for G7 countries that their frequency approximately lies between 25 and 30 years, and hence that the identification of medium-term cycles is justified.

Figure 3.4. Two possible stylized ways to look at medium-term fluctuations

Note: stylized representation, does not necessarily reflect developments in particular EMU countries.

3.2.2 The monetary union perspective

Relatively little is known yet about how medium-term fluctuations behave in a monetary union. Only a few papers have so far applied ideas that resemble medium-term fluctuations to EMU. De Grauwe and Yi (2016) and Alcidi (2017) calculate longer-lasting fluctuations for euro area countries

in the EMU-period, and conclude that they differ in amplitude. Models by Cuerpo et al. (2013), In 't Veld et al. (2014) and Martin and Philippon (2017) show that the interaction between financial factors and adjustment channels in EMU induced large and long-lasting asymmetric fluctuations. Yet the broader literature on the euro crisis indirectly allows three conclusions regarding possible medium-term fluctuations in EMU.

First, any potential medium-term fluctuations in EMU are more likely to be related to financial factors than to real factors (Lane, 2013; Obstfeld, 2013). The start of EMU coincided with a period of strong financial development and integration worldwide, stimulated even further by the single currency (Forbes, 2012). Yet there was a strong asymmetry in this development, as credit and house price growth has been stronger in the periphery than in the core of the euro area (Samarina et al., 2015). This is partly because these countries were expected to have upward convergence potential (Giavazzi and Spaventa, 2010) and partly because they benefited from a strong decrease in (real) long-term interest rates in the run-up to EMU-membership. There is less evidence that the medium-term fluctuations in the euro area are related to productivity. On the contrary, the strong increase in credit in Southern European countries has spurred growth of non-tradable sectors with lower productivity (Gilbert and Pool, 2016), and helped to uphold low-productive companies that would otherwise have gone bankrupt (Reis, 2013). The benign financial conditions also induced a postponement of structural reforms (Fernández-Villaverde et al., 2013) and an increase in structural differences between member states (Buti and Turrini, 2015).

Second, medium-term fluctuations could be related to the buildup and correction of macroeconomic imbalances in EMU. Imbalances in price competitiveness, current accounts and budget deficits seem partly driven by asymmetric financial cycles (De Haan et al., 2016). Vice versa, especially the correction of these imbalances has had a longer-lasting effect on GDP. Several channels may amplify the interaction between medium-term fluctuations and imbalances:

Relative prices. In a monetary union, fluctuations could be amplified and prolonged via the interaction with relative prices. The effects depend on the relative strength of the competitiveness channel and the real interest rate channel (European Commission, 2008b). A positive asymmetric fluctuation increases relative prices vis-à-vis other EMU member states, and this has two opposing effects. First, the resulting loss of competitiveness slows growth and dampens the fluctuation. Second, higher inflation decreases real interest rates and amplifies the fluctuation: the so-called Walters' effect (Mongelli and Wyplosz, 2008). In the euro area, the competitiveness channel is weak due to wage and price rigidities (Biroli et al., 2010). As a result, asymmetric fluctuations caused longer-lasting differences in real interest rates that amplify the fluctuation: a *super Walters' Effect* (Buti and Turrini, 2015; Bonam and Goy, 2017). During the downturn, both channels work in the opposite direction and amplify the slowdown. The need to restore competitiveness reduces inflation and increases real interest rates, which were already higher due to the increase in risk premia after the crisis.

Current accounts and capital flows. The interaction with current accounts and capital flows may also amplify fluctuations. Credit driven domestic demand booms are an important cause of current account deficits in southern Europe, while the need to correct these deficits after the crisis has contributed to the downturn in these countries (Gaulier and Vicard, 2012; Wyplosz, 2013; Comunale and Hessel, 2014; Gilbert and Pool, 2016). This channel is amplified further by capital flows. Benign financial conditions before the crisis enabled peripheral countries to finance current account deficits that would have been unsustainable in more normal circumstances. Moreover, capital inflows helped to amplify the credit boom (Samarina and Bezemer, 2016). During the downturn, capital outflows may have amplified the adjustment in current accounts and deepened the downturn (Martin and Philippon, 2017), although the public sector financial aid that became available via the ESM and the ECB softened part of the adjustment (Gross and Alcidi, 2015b).

Fiscal policy. The interaction with fiscal policy could amplify fluctuations as well. Medium term financial cycles can have large effects on public finances (Bénétrix and Lane, 2015). Financial booms increase government revenue. Rising asset prices increase revenue from capital gains and transaction taxes, while wealth effects drive up the share of domestic demand and thereby revenue from indirect taxes (Eschenbach and Schuknecht, 2004; Dobrescu and Salman, 2011; Lendvai et al., 2011). In practice, the temporary revenues are often mistaken for structural improvements, and therefore lead to procyclical government spending, that amplifies the boom. This reverses when the downturn of the financial cycle causes an unusually strong decline in public revenue and a much larger budgetary deterioration than normal (Gilbert and Hessel, 2014; Bénétrix and Lane, 2015). It forces countries into budgetary consolidation that amplifies the downturn.

A third and final conclusion from the literature is that EMU could be more prone to asymmetric medium-term fluctuations than the US. Adjustment mechanisms work better in the US, due to higher labour mobility (Beyer and Smets, 2015), the presence of a federal budget (Sala-i-Martin and Sachs, 1992) and better private risk-sharing due to more advanced financial integration (Asdrubali et al., 1996). In addition, the channels described above may be stronger and more asymmetric in the euro area. Financial developments could be more asymmetric due to decreasing long-term interest rates in some countries at the start of EMU and due to differences in financial systems between member states. The interaction with relative prices could also be stronger in EMU, because higher inflation persistence strengthens and prolongs real interest rates differentials (European Commission, 2015). Moreover, EMU is more bank-based and banks are more attached to their domestic market, which could amplify downturns if non-performing loans reduce local banks' lending capacity (Hoffmann and Sørensen, 2015). Finally, EMU countries seem more vulnerable to capital flight than US states, because government debt is issued at the decentralized level, the sovereign-bank nexus is relatively strong and a lender of last resort for sovereigns is lacking (De Haan et al., 2016).

3.3 Methodology

As mentioned, our central hypothesis is that looking at medium-term fluctuations rather than short-term fluctuations leads to a less benign view on the functioning of EMU as an optimum currency area, that is more in line with the experience of the debt crisis. To confirm this hypothesis, we need to establish that medium-term fluctuations in the euro area are less symmetric than short-term fluctuations. In addition, we need to establish that these asymmetric medium-term fluctuations are relevant for the functioning of EMU as an optimum currency area, and do not reflect divergences in the “genuine” growth potential of member states that may be relatively harmless. Our analysis therefore consists of three main parts.

3.3.1 Symmetry of medium-term fluctuations

Calculation of fluctuations

In the first part, we compare the symmetry of medium-term fluctuations in the euro area to that of short-term fluctuations. We also compare the fluctuations in the euro area with fluctuations in US states and regions. We first perform spectral density analyses to identify whether medium-term fluctuations are present. Spectral density estimates show at which frequencies the mass of the cyclical oscillations in GDP occurs (De Winter et al., 2017). The spectral densities of all EMU countries clearly have a (local) peak at medium-term frequencies between 64 quarters (15 years) and 191 quarters (48 years)(table 3.1). This confirms the finding from De Winter et al. (2017) for G7 countries. At the same time, the periodograms show that the importance of the peak at medium-term frequencies varies. Medium-term fluctuations are very dominant in countries like Greece, Ireland and Spain (figure 3.5, left panel), while countries like Austria, Germany and France display more mixed fluctuations at short- and medium term frequencies (figure 3.5, right panel). We conclude that it is justified to calculate medium-term fluctuations for euro area countries, but that their importance will likely differ from country to country (see also section 3.5.1 below).

Table 3.1. Length medium term in spectral density

	GDP	Domestic Demand
AT	96	64
B	63	63
D	21	38
FI	96	32
FR	96	64
GR	95	95
IR	95	95
IT	191	191
NL	96	96
PT	191	96
SP	64	64
EMU	63	63

Note: length expressed in number of quarters. The length is determined by identifying the lowest frequency (local) peak in the periodogram obtained via spectral density analysis.

We calculate short-term and medium-term fluctuations for euro area countries with the bandpass or Christiano-Fitzgerald filter. For short-term fluctuations, we use the standard bandpass filter for fluctuations between 2 and 32 quarters (8 years). The frequency used to calculate medium-term fluctuations varies somewhat in the literature. Comin and Gertler (2006) use frequencies between 2 and 200 quarters (50 years), while Drehmann et al. (2012) use frequencies between 2 and 120 quarters (30 years). We follow Comin and Gertler (2006), partly based on our spectral density analysis, but it should be noted that the results are not very sensitive to this choice.³ This is partly because the filter takes up all fluctuations with a frequency *up to* 50 years, and it turns out that most of the medium-term fluctuations in GDP have a lower frequency than that (see also section 3.5.1 below).⁴ Therefore, we are confident that our choice of frequency will not lead to overly long or

³ Importantly, the aim of our paper is to shift the perspective on the frequency of fluctuations from the short-term to the medium-term, and not necessarily to find the most reliable or accurate estimates of financial cycles, medium-term output gaps or “genuine” potential GDP. From our perspective, the exact choice of medium-term frequency is less important.

⁴ Moving from 30 years to 50 years does not make much difference. We have re-estimated part of our analysis with fluctuations calculated with a bandpass filter over 30 years, and the differences turned out to be small. In addition, results with a HP-filter with a frequency between 16 and 20 years are also very comparable.

"spurious" cycles.

Figure 3.5. Periodograms spectral densities

Note: the calculated spectral densities are truncated.

We apply these bandpass filters to GDP, but also to domestic demand. This comes by following Dobrescu and Salman (2011), Lendvai et al. (2011), Comunale and Hessel (2014) and Bénétrix and Lane (2015). Domestic demand should provide a better measure of domestic absorption that is driven by financial factors, such as credit and house prices, than GDP. In addition to these central measures, we use a number of other methods in order to check the robustness of our results.⁵ For short-term fluctuations we also use the output gap calculated by the European Commission. This measure is based on a production function method, and is widely used in policy discussions.

Symmetry measures

We compare medium-term fluctuations with short-term fluctuations via a number of measures. The *size* of fluctuations is approximated by the stan-

⁵We also apply the Hodrick-Prescott filter to GDP and domestic demand. We calculate short-term fluctuations with the traditional value for the smoothing parameter λ of 1,600. For the medium-term fluctuations, we use a values of λ of 100,000, that should filter out fluctuations with a mean duration of 16-20 years (Alessi and Detken, 2009; Drehmann et al., 2010). In addition, in the spirit of Borio et al. (2013; 2014) we obtain medium-term fluctuations by estimating the principle component of: i) the output gap calculated with an HP-filter with λ 1,600, ii) the growth in real house prices and iii) the growth in real credit to the private sector. While Borio et al. (2013; 2014) use a Kalman-filter, our measure only captures co-movement and does not impose a frequency.

dard deviation over certain periods. For the *symmetry* of fluctuations, we do not use ordinary correlation coefficients, as they are an imperfect measure (Mink et al., 2012). Correlations do not properly take into account whether or not fluctuations have the same sign, and also do not take into account differences in the amplitude of fluctuations (figure 3.6).

Figure 3.6. Difference in phase and amplitude of cycles

Note: stylized representation, does not necessarily reflect developments in particular EMU countries.

As an alternative, we first use the *synchronicity* of fluctuations (Mink et al., 2012). It measures the extent to which the cycle of a certain country has the same sign (i.e. positive or negative) as the cycle of a reference country - in this case the euro area (figure 3.6, left panel).⁶ The synchronicity index varies between a maximum of 1 (when all gaps have the same sign as the reference country) and a minimum $-1+2/n$, which equals -1 for large n (when all gaps have the opposite sign). The index is calculated as:

$$\text{synchronicity} = \frac{1}{n} \sum_{i=1}^n \frac{g_{i,t} g_{ref,t}}{|g_{i,t} g_{ref,t}|} \quad (3.1)$$

The second measure is the *similarity* index (Mink et al., 2012), which

⁶ Mink et al. (2012) argue that the cross-section *median* of the output gaps in the sample should be used as the reference cycle. However, calculations in our sample show that this median fluctuation is very close to the fluctuation of the euro area as a whole. We therefore use the euro area fluctuation as the reference cycle, as it is more easy to interpret.

roughly measures the extent to which fluctuations in different countries are similar in amplitude (figure 3.6, right panel). As mentioned before, in a monetary union differences in the amplitude of fluctuations may matter just as much as differences in the phase of fluctuations. The measure relates the (absolute) size of differences between the fluctuations of a certain country and the euro area reference cycle to the (absolute) size of the fluctuations in the country itself. The similarity index varies between a maximum of 1 (when all fluctuations are exactly similar) and a minimum of 2-n. It is calculated as:

$$similarity = 1 - \frac{\sum_{i=1}^n |g_{i,t} - g_{ref,t}|}{\sum_{i=1}^n |g_{i,t}|} \quad (3.2)$$

The third measure we use is another proxy for the similarity of fluctuations. We use the R-squared, which we determine here as the fraction of the variation in fluctuations in the sample that can be explained by the variation in the fluctuation of the reference country.⁷ This R-squared is comparable to the similarity index, but is closer to more widely-used concepts. It naturally varies between 0 and 1. Because the R-squared uses squared deviations, rather than average absolute deviations, it is more sensitive to large deviations than the similarity index, and may therefore be more volatile. The R-squared is calculated as:

$$R^2 = \frac{n \sum_{t=1}^n (g_{ref,t} - \bar{g})^2}{\sum_{i,t=1}^n (g_{i,t} - \bar{g})^2} \quad (3.3)$$

⁷ The R-squared calculated in this way is similar to the R-squared of a panel-regression of country-specific output gaps on the aggregate output gap, where we impose that the coefficient of the aggregate output gap equals 1.

3.3.2 Drivers of medium-term fluctuations

In the second part of our analysis, we try to relate medium-term fluctuations to their potential drivers from the literature. We look at the relative role of *real* drivers, in particular productivity, and *financial* drivers, in particular credit and house prices. The literature suggests that especially medium-term fluctuations driven by financial factors cause macroeconomic imbalances and crises. Therefore the relative importance of financial drivers should give an indication of the potential harmfulness of medium-term fluctuations and their relevance for the functioning of EMU.

We relate the medium-term fluctuations in GDP (and domestic demand) to medium-term fluctuations in potential real and financial drivers. We focus on the deviations from the EMU-aggregate.⁸ We estimate the following equation for our panel of EMU-countries:

$$relative_output_gap_{i,t} = c + c_i + relative_driver_gap_{i,t} + \varepsilon_{i,t} \quad (3.4)$$

Here $relative_output_gap_{i,t}$ is the relative medium term fluctuation in GDP (or domestic demand) of country i vis-à-vis the EMU-aggregate, c is a constant and c_i are country-specific fixed effects. The variable $relative_driver_gap_{i,t}$ captures the medium-term fluctuations in the potential underlying drivers in country i vis-à-vis the EMU-aggregate. We investigate the role of two real drivers, labour productivity and total factor productivity (Blanchard, 1997; Comin and Gertler, 2006), and two financial drivers, real credit and real house prices (Drehmann et al., 2012).

We estimate our model using weighted least squares (GLS) to account for possible cross-country heteroskedasticity. As endogeneity of some of the explanatory variables may be an issue, we also use GMM (Arellano-Bond estimator), using first-differenced data for the instrument weighting matrix.⁹ We use as internal instruments the lagged values of the respective un-

⁸ We have also performed all analyses for the levels of medium-term fluctuations. The results are qualitatively mostly similar, but somewhat less pronounced.

⁹ We have also estimated the model with OLS. Results are comparable but less pronounced.

derlying drivers. We add these potential underlying drivers one by one, to prevent multicollinearity due to correlation between the explanatory variables.¹⁰ We then calculate how much of the variation in medium-term fluctuations can be explained by the respective potential drivers with the *partial* R^2 . The partial R^2 is calculated by taking the variation from the explanatory variable multiplied by its coefficient in the regression, and dividing this by the variation in the dependent variable.

3.3.3 Connection with euro area imbalances

Third, we investigate if the buildup and correction of imbalances in price competitiveness, current accounts and budget deficits in EMU can be related to medium-term rather than short-term fluctuations. According to the literature, these imbalances are at least partly related to medium-term oriented financial cycles (De Haan et al., 2016). A clear link between medium-term fluctuations and these imbalances would therefore be a further indication on their relevance for the functioning of EMU as an optimum currency area.

We estimate three separate panel models, where the relevant imbalance is related to a number of explanatory variables that include (relative) output gaps. We estimate these models with short-term and with medium-term output gaps, and then see whether the medium-term fluctuations explain more of the variation than short-term fluctuations. We do this again by calculating the partial R^2 . We primarily focus on the period since the start of EMU, 1995-1999 to 2016. We again estimate our model using weighted least squares (GLS) and GMM (Arellano-Bond first differenced specification).¹¹

The first model for **relative prices** is derived from Biroli et al. (2010) and European Commission (2015). We estimate the following equation:

¹⁰ We also ran multivariate regressions where we included both financial and real variables as drivers, which confirm the overall conclusions of the univariate regressions. Simple tests show that the risk of multicollinearity between real and financial variables is not high for the full sample, but could be an issue in subperiods.

¹¹ We have also estimated the model with OLS. Results are comparable but less pronounced.

$$\Delta reer_{i,t} = c + c_i + \Delta reer_{i,t-1,\dots,i,t-4} + reer_{i,t-1} + relative_gap_{i,t-1} + \varepsilon_{i,t} \quad (3.5)$$

Here $\Delta reer_{i,t}$ is the change in relative prices, measured by the real effective exchange rate against other euro area countries.¹² As explanatory variables, c is a constant and c_i are country fixed effects. We incorporate four lags of $\Delta reer_{i,t}$ to capture the persistence of relative price changes. We also incorporate $reer_{i,t-1}$, the lagged level of the real effective exchange rate, which captures mean reversion due to the competitiveness channel (see literature section). Finally, we incorporate the (lagged) relative output gap ($relative_gap_{i,t-1}$), that should capture how relative prices respond to asymmetric fluctuations.

The second model for **current account balances** is derived from Guillemette and Turner (2013), Comunale and Hessel (2014) and Lane and Milesi-Ferretti (2015). We regress current account balances on a number of fundamental and cyclical factors. We estimate the equation:

$$ca_{i,t} = c + c_i + gdp/capita_{i,t} + \Delta pop_{i,t} + dep_{i,t} + bb_{i,t} + fd_{i,t} + reer_{i,t} + gap_{i,t} + \varepsilon_{i,t} \quad (3.6)$$

Here $ca_{i,t}$ is the current account balance as a percentage of GDP. As fundamental factors we incorporate GDP per capita ($gdp/capita_{i,t}$) to capture convergence effects, population growth ($\Delta pop_{i,t}$) because societies with young children tend to save less, and the old-age-dependency ratio ($dep_{i,t}$) as countries with more aged populations also tend to save less. As cyclical factors, we use the budget balance ($bb_{i,t}$), and country specific foreign demand

¹² We therefore focus on internal price adjustment and exclude exchange rate effects. We check the sensitivity of the results by moving to measures of the real effective exchange rate compared to a broader group of trade partners, also outside the euro area. In addition, we also estimated the model for real effective exchange rates based on the consumer price index and the GDP-deflator. Both changes do not affect the outcomes much.

($fd_{i,t}$) to capture differences in export destination (Chen et al., 2012). We also incorporate price competitiveness, this time the real effective exchange rate ($reer_{i,t}$) against a broader group of 37 countries. Finally, we include various short and medium-term output gaps ($gap_{i,t}$).

Finally, the third model for **budget balances** is loosely based on Bénétrix and Lane (2015) and Berti et al. (2016). We estimate the following equation:

$$bb_{i,t} = c + c_i + bb_{i,t-4} + d_{i,t-4} + i_{i,t} + fri_{i,t} + gap_{i,t} + \varepsilon_{i,t} \quad (3.7)$$

Our dependent variable is the budget balance ($bb_{i,t}$). The first explanatory variable is the lagged budget balance that should capture fiscal policy inertia. We also incorporate the public debt ratio ($d_{i,t-4}$). Higher debt may worsen the budget balance via higher interest payments, or it may improve the budget balance as countries take measures to restore fiscal sustainability. We also include the long-term (nominal) interest rate ($i_{i,t}$) that may have an upward effect on the budget balance, and the fiscal rules index ($fri_{i,t}$) as proxy for the quality of fiscal frameworks. Finally, we again include the various measures of short-term and medium-term output gaps ($gap_{i,t}$).

3.4 Data

Our sample contains the member states that joined EMU from the beginning or shortly thereafter (Greece), with the exception of Luxemburg, for which not all relevant data were available. For some parts of the analysis, we compare the euro area with US states and regions.¹³ We use quarterly data from 1970 to 2016, or sometimes for shorter subperiods.

¹³ The 8 U.S. regions are New England, Mideast, Great Lakes, Plains, Southeast, Southwest, Rocky Mountains and Far West. We use both states and regions because it is not entirely clear which are most comparable to EMU member states. US states are on average about 2.7 times smaller than EMU member states in terms of GDP, so US states may be more specialised and therefore more prone to asymmetric fluctuations than EMU member states. By contrast, US regions are on average about 2.4 times larger than EMU member states, so that some of the asymmetric fluctuations may average out.

For the first part of the analysis (symmetry of fluctuations) we used a number of data sources. The data on GDP and domestic demand for EMU countries are quarterly data from the OECD database. We also use the European Commission's output gaps from the AMECO database, and interpolate these data to obtain quarterly data. For US states and regions, the US Bureau of Economic Analysis (BEA) only has data for GDP, not for domestic demand. These data go back to 1978 and are part quarterly and part annual data that are interpolated.

For the second part of the analysis (potential drivers of medium-term fluctuations) we used the following additional data. Data on labour productivity are quarterly data from the OECD. For some countries these are complemented with annual data that are interpolated. The data on total factor productivity are annual data from the AMECO database, and are also interpolated. The quarterly data on nominal house prices are taken from the OECD, while quarterly data on credit to the non-financial domestic sector are taken from the BIS. Nominal data are made real on the basis of the GDP-deflator from the OECD.

For the third part of the analyses (connection with euro area imbalances), we focus on the period 1995 to 2016. This is partly due to data availability, and partly because this captures the EMU-period and the runup towards it. We use the following additional data. For the model on relative prices, we use quarterly data on the real effective exchange rate come from the European Commission. We take real effective exchange rates measured in unit labour costs for the whole economy compared to other euro area countries. For the model on current accounts, quarterly data on current account balances come from the IMF International Financial Statistics (IFS) database. GDP per capita comes from the IMF WEO database, while data on population growth and the old-age-dependency ratio come from Eurostat, and data on the budget balance come from the AMECO database. These series are annual and hence interpolated. Country-specific foreign demand is calculated by weighing GDP-growth of countries and regions by their ex-

port weights from the IMF Direction Of Trade Statistics (DOTS) (Comunale and Hessel, 2014). In this model we also incorporate the real effective exchange rate (from the European Commission), but this time it is measured in unit labour cost against a broader group of 37 countries. For the model on budget balances, quarterly data on long-term interest rates come from the OECD. Data on budget balances and government debt come from the AMECO database, complemented by data from Mauro et al. (2015), while the data on the fiscal rules index come from the European Commission. Annual data are again intrapolated.¹⁴

3.5 Results

3.5.1 Symmetry of medium-term fluctuations

We want to know whether looking at medium-term fluctuations instead of short-term fluctuations leads to a less benign view on the functioning of EMU as an optimum currency area. We therefore first investigate whether medium-term fluctuations in the euro area are less symmetric than short-term fluctuations. We present measures on the *size* and the *symmetry* of both types of fluctuations over 10-year rolling windows since 1970 (figures 3.7 and 3.9) and for the EMU-period 1999-2016 (table 3.2 and figure 3.8). We also compare short-term and medium-term fluctuations in the euro area to those in US states and regions (table 3.4 and figure 3.10). Three conclusions emerge.

First, medium-term fluctuations in the euro area are much larger than short-term fluctuations. This confirms the findings of Comin and Gertler (2006) and Drehman et al. (2012). The standard deviation of medium-term fluctuations is around 2 to 3 times larger than the standard deviation of short-term fluctuations (table 3.2). Moreover, the difference has increased over time (figure 3.7). Short-term fluctuations have gradually become

¹⁴ This is somewhat unusual for fiscal data, but it fits better to our measures of fluctuations and also allows us to maintain the same quarterly frequency for all analyses in the paper.

smaller since the 1970s, in line with the *great moderation* (figure 3.7, upper and lower left panels).¹⁵ By contrast, medium-term fluctuations have not become smaller, and recently even increased to their highest level since the 1970s (figure 3.7 upper and lower right panels).

Table 3.2. Properties short and medium-term cycles in EMU

		volatility		symmetry		R^2
		gap	diff _{EMU}	synchronicity	similarity	
short-term	GDP _{BP}	1.36	0.84	0.78	0.25	0.80
	GDP _{EC}	2.51	1.53	0.69	0.33	0.43
	DD _{BP}	1.52	1.15	0.39	0.14	0.40
medium-term	GDP _{BP}	4.07	3.13	0.54	0.15	0.17
	DD _{BP}	5.17	4.28	0.48	0.13	0.15

Note: calculations with quarterly data for the period 1999-2016 and presented as unweighted averages for 11 EMU countries. Fluctuations are calculated for GDP and domestic demand separately. Volatility is calculated as the standard deviation, and is applied to country-specific fluctuations, as well as to the deviation of these fluctuations from the EMU-aggregate. The three measures of symmetry (synchronicity, similarity and R^2) are described in section 3.3.1.

A qualification to this first conclusion is that this result does not hold for all member states in the EMU period (figure 3.8). In countries like Belgium, France and Germany, medium-term fluctuations are about as large as short-term fluctuations. Medium-term fluctuations are larger than short-term fluctuations in countries like Spain, Portugal, Ireland and Greece - exactly the countries with the largest macroeconomic imbalances before the crisis (see section 3.5.3 below). The length of the most recent medium-term fluctuations also differs between countries (table 3.3). For some countries, the medium-term fluctuations are not that much longer than the short-term fluctuations, ranging between 17 quarters (4 years) and 36 quarters (9 years). However, countries like Spain, Portugal, Ireland and Greece have medium-term fluctuations between 52 quarters (13 years) and 83 quarters (21 years), hence substantially longer than the short-term fluctuations. These results confirm the results from our spectral density analysis (section 3.3.1) indicating that the importance of medium-term fluctuations differs between coun-

¹⁵ While the crisis has increased their volatility, it remains below the peaks in the 1970s.

tries.¹⁶ Moreover, they also confirm that our calculations do not necessarily lead to too long or “spurious” cycles.

Table 3.3. Length most recent cycle

	GDP		Domestic Demand	
	short term	medium term	short term	medium term
AT	26	27	25	25
B	9	17	25	20
D	25	36	23	112
FI	26	30*	26	53
FR	25	50	26	46
GR	13	52*	15	72*
IR	12	72	25	70
IT	28	72*	22	73*
NL	7	77	17	79
PT	20	81*	19	83*
SP	20	69	19	71*
EMU	25	52	25	72

Note: length expressed in number of quarters. The length is calculated as the number of quarters between the two points where the calculated (short-term or medium-term) output gap turns from negative to positive in the sample. The * means that the most recent cycle has not ended yet at the end of the sample (2017Q4), because the output gap was still negative.

Second, medium-term fluctuations in the euro area are less symmetric than short-term fluctuations (table 3.2 and figure 3.9). This is not so much related to the phase of fluctuations: the synchronicity of medium-term fluctuations is comparable to the synchronicity of short-term fluctuations (figure 3.9, upper two panels).¹⁷ The main reason why medium-term fluctuations are less symmetric is that differences in amplitudes are larger: medium-term fluctuations are substantially less similar than short-term fluctuations (see also De Grauwe and Yi, 2016). Both the similarity index and the R-squared are clearly lower for medium-term fluctuations (table 3.2). In addition, medium-term fluctuations have become less symmetric over time, while short-term fluctuations have become more symmetric. The similarity

¹⁶ To an important extent, the countries that have longer and larger medium-term fluctuations calculated with the bandpass filter are also the countries that have a clearer peak in their spectral density at medium-term frequencies.

¹⁷ Although for short-term fluctuations, the synchronicity of domestic demand fluctuations is clearly lower than for GDP fluctuations.

Figure 3.7. Volatility short-term and medium-term fluctuations

Note: volatility calculated as the standard deviation over a 10-year (40 quarter) rolling window for the period 1970-2016. The short-term gaps for GDP and domestic demand (DD) are calculated with a bandpass filter with a frequency up to 32 quarters. The medium-term gaps for GDP and domestic demand (DD) are calculated with a bandpass filter with a frequency up to 200 quarters.

of short-term fluctuations has increased (figure 3.9, middle and bottom left panels), which confirms the benign findings of Gächter and Riedl (2014) and Campos and Macchiarelli (2016). But by contrast, medium-term fluctuations have become less similar since the 1970s (figure 3.9, middle and bottom right panels).

Third, medium-term fluctuations in EMU are less symmetric than in the US, while short-term fluctuations are more symmetric. Short term fluctuations in the euro area have about the same size as in US states and regions (table 3.4). More importantly, short-term fluctuations are more symmetric in

Figure 3.8. Volatility individual EMU countries 1999-2016

Note: volatility calculated as the standard deviation over the period 1999-2016. The short-term gaps for GDP and domestic demand (DD) are calculated with a bandpass filter with a frequency up to 32 quarters. The medium-term gaps for GDP and domestic demand (DD) are calculated with a bandpass filter with a frequency up to 200 quarters.

the euro area, which confirms the findings of Van Beers et al. (2014). Short-term fluctuations in the euro area are more synchronized than in US states and regions (figure 3.10, upper left panel), while their similarity is comparable (similarity index) or higher (R^2) than in the US (middle and lower left panels). By contrast, medium-term fluctuations in the euro area are less symmetric than in the US: both the synchronicity and the similarity of medium-term fluctuations is substantially lower (figure 3.10, right panels).¹⁸

All in all, our focus on medium-term instead of short-term fluctuations clearly changes the picture. Our analysis of short-term fluctuations in the euro area largely confirms the benign findings in the rest of the literature: these fluctuations have become smaller and more symmetric, and are more symmetric than in the US. However, our analysis of medium-term fluctuations leads to substantially less benign findings: these have become larger

¹⁸ An interesting addition is that the size of medium-term fluctuations is surprisingly similar in the euro area and the US (table 3.4). This is in line with Martin and Philippon (2017), who show that the fluctuations in employment are very similar in Arizona and Ireland, as well as in Florida and Spain.

Figure 3.9. Symmetry of short-term and medium-term fluctuations EMU

Note: synchronicity index, similarity index and R-squared calculated over a 10-year rolling window for the period 1970-2016 (see section 3.3.1).

Figure 3.10. Comparison of symmetry of fluctuations in EMU and US

Note: synchronicity index, similarity index and R-squared calculated over a 10-year rolling window for the period 1970-2016 and 1978-2016 for US states and regions (see section 3.3.1).

Table 3.4. Short and medium-term cycles EMU and US

		volatility		symmetry		R ²
		gap	diff _{EMU}	synchronicity	similarity	
short-term	EMU	1.36	0.84	0.78	0.25	0.80
	US regions	1.09	0.61	0.62	0.36	0.67
	US states	1.43	1.16	0.41	0.14	0.36
medium-term	EMU	4.07	3.13	0.54	0.15	0.17
	US regions	3.21	1.47	0.81	0.51	0.78
	US states	4.23	3.28	0.56	0.24	0.43

Note: calculations with quarterly data for the period 1999-2016 and presented as unweighted averages for EMU countries, US states and US regions. Cycles are calculated on the basis of GDP (as domestic demand was not available for US states and regions). Volatility is calculated as the standard deviation, and is applied to country-specific fluctuations, as well as to the deviation of these fluctuations from the aggregated fluctuation for EMU or the US as a whole. The three measures of symmetry are described in section 3.3.1.

and less symmetric, and are less symmetric than in the US.

3.5.2 Drivers of medium-term fluctuations

We then try to relate medium-term fluctuations to their potential real and financial drivers. The importance of financial drivers should give an indication on the potential harmfulness of medium-term fluctuations and their relevance for the functioning of EMU. As a first step, we plot bivariate correlation coefficients over a 10 year rolling window (figure 3.11). The correlation of medium-term fluctuations with financial drivers has clearly increased since the 1970s, both for credit (figure 3.11, lower left panel) and house prices (lower right panel). By contrast, the correlation of medium-term fluctuations with real drivers has gradually decreased since the 1970s. The decrease is most pronounced for fluctuations in labour productivity (figure 3.11, upper left panel), while the correlation with total factor productivity has remained higher, especially for GDP (upper right panel).

These results are confirmed by panel regressions performed over three time periods of comparable length: 1970-1985, 1986-1998 and 1999-2016. We show for every potential driver and subperiod the estimated coefficient of the panel regression, as well as the partial R^2 (tables 3.5 and 3.6 for GLS and

Figure 3.11. Correlation medium-term fluctuations with potential real and financial drivers

Note: correlations calculated over a 10-year rolling window for the period 1970–2016. The fluctuations are expressed in deviation from the EMU-aggregate. The two upper panels show that medium-term fluctuations in GDP and domestic demand have become less strongly correlated with medium-term fluctuations in labour and total factor productivity. The two lower panels show that medium-term fluctuations in GDP and domestic demand have become more strongly correlated with medium-term fluctuations in credit and house prices.

GMM estimations). We find a consistent increase in the explanatory power of both financial variables, house prices and credit. We also find a consistent decrease in the explanatory power of labour productivity, but not of total factor productivity.

Table 3.5. Univariate regressions drivers - GLS

			deviations EMU-aggregate			
			1970-1985	1986-1998	1999-2016	change
estimates for GDP gap						
real drivers	productivity	coefficient	0.42**	0.33**	0.43**	
		partial R ²	0.26	0.06	0.06	↓
	tfp	coefficient	0.58**	0.91**	0.96**	
		partial R ²	0.20	0.35	0.44	↑
financial drivers	credit	coefficient	-0.01**	0.05**	0.11**	
		partial R ²	0.00	0.04	0.09	↑
	house prices	coefficient	0.12**	0.13**	0.20**	
		partial R ²	0.32	0.19	0.35	↑
estimates for domestic demand gap						
real drivers	productivity	coefficient	0.50**	0.23**	0.03	
		partial R ²	0.17	0.01	0.00	↓
	tfp	coefficient	0.80**	0.97**	0.99**	
		part R ²	0.18	0.22	0.28	↑
financial drivers	credit	coeff	-0.00*	0.07**	0.16**	
		part R ²	0.00	0.03	0.10	↑
	house prices	coeff	0.12**	0.24**	0.28**	
		part R ²	0.14	0.35	0.44	↑

Note: panel regressions for underlying drivers of medium term fluctuations for 11 EMU countries in 3 different time periods, using GLS with cross-section weights, country fixed effects and white robust standard errors. All medium-term fluctuations are expressed in deviation from the fluctuation for EMU as a whole. The table contains the coefficients of the underlying drivers as well as their significance (* is 5% significance, ** is 1% significance). The partial R² is calculated as the share of the variation in medium-term fluctuations explained by the respective underlying driver (see section 3.3.2).

To see what this means in practice, we show how well the real and financial drivers explain differences in medium-term fluctuations in EMU at the last peak (second half of 2007) and trough (first half of 2013) of the cycle (figure 3.12). We calculate the contributions of the drivers by multiplying their value by the coefficient in the regression. The results show that

Table 3.6. Univariate regressions drivers - GMM

			deviations EMU-aggregate			
			1970-1985	1986-1998	1999-2016	change
estimates for GDP gap						
real drivers	productivity	coefficient	0.61**	0.29*	0.81	
		partial R ²	0.55	0.05	0.23	↓
	tfp	coefficient	0.79**	0.95**	0.93**	
		partial R ²	0.38	0.38	0.41	↑
financial drivers	credit	coefficient	-0.02	0.14	0.36**	
		partial R ²	0.01	0.26	0.89	↑
	house prices	coefficient	0.04	0.25**	0.29**	
		partial R ²	0.04	0.72	0.76	↑
estimates for domestic demand gap						
real drivers	productivity	coefficient	0.69**	0.15	0.76	
		partial R ²	0.34	0.01	0.12	↓
	tfp	coefficient	0.87**	1.10**	1.02**	
		partial R ²	0.22	0.28	0.29	↑
financial drivers	credit	coefficient	-0.05	0.19	0.49**	
		partial R ²	0.02	0.26	0.99	↑
	house prices	coefficient	0.07	0.34**	0.39**	
		partial R ²	0.05	0.71	0.83	↑

Note: panel regressions on underlying drivers of medium-term fluctuations for 11 EMU countries in 3 different time periods, using GMM with first-differences for the instrument weighting matrix (Arellano-Bond) and White standard errors. We use as internal instruments the lagged values of the respective underlying drivers. All medium-term fluctuations are expressed in deviation from the fluctuation for EMU as a whole. The table contains the coefficients of the underlying drivers as well as their significance (* is 5% significance, ** is 1% significance). The partial R² is calculated as the share of the variation in medium-term fluctuations explained by the respective underlying driver (see section 3.3.2).

real drivers explain part of the differences in medium-term fluctuations, but that the role of financial factors is also very important. At the peak of the cycle, differences in productivity cannot explain why the output gap is so far below the EMU-aggregate in Germany, and so far above it in Ireland and Spain (figure 3.12, upper left panel). These differences are mainly due to financial factors: credit and house price developments have been subdued in Germany and buoyant in Spain and Ireland (figure 3.12, upper right panel). A similar picture emerges at the trough of the cycle. Differences in productivity cannot explain why medium-term output gaps are far below average in

Spain, Ireland and Finland, and above-average in Germany and France (figure 12, lower left panel). These differences are again related to financial factors: house prices did not decrease much in Germany and France, while they decreased sharply in Spain, Ireland and Finland (figure 3.12, lower right panel).¹⁹

Figure 3.12. Contributions drivers to peak and trough medium-term fluctuations

Note: the dots represent the actual medium-term output gaps in GDP relative to the EMU-aggregate at the peak (2007H2) and trough (2013H1) of the medium-term cycle. The bars represent the contributions of the respective medium-term gaps in the underlying drivers to these medium-term GDP-gaps. The contributions are calculated as the medium-term gap in the underlying driver (labour and total factor productivity, credit and house prices) multiplied by the relevant coefficient taken from the GLS estimation (table 3.5 above).

¹⁹ House prices perform better than credit. This may be because it is difficult to reduce outstanding credit (a stock variable) quickly during a bust phase. That would require very rapid deleveraging and/or widespread defaults.

All in all, we show that medium-term fluctuations have become more strongly connected to financial factors like credit and house prices, while real factors like productivity have become less important. This confirms the findings of Drehmann et al. (2012) that financial cycles have become more pronounced due to financial deregulation and integration. It also confirms the results of Jordá et al. (2016) that the strong increase in financial development has influenced the characteristics of fluctuations. Financial factors seem to explain an important part of the recent asymmetries in medium-term fluctuations in the euro area. The increased connection with financial factors has made medium-term fluctuations more relevant for the functioning of EMU as an optimum currency area. This type of fluctuations tends to be more harmful and tends to increase the risk of imbalances and crises.

3.5.3 Connection with euro area imbalances

Relative prices

We then investigate if the buildup and correction of imbalances in price competitiveness, current accounts and budget deficits in EMU can be related to medium-term rather than short-term fluctuations. A clear link with medium-term fluctuations would be a further indication of the relevance of these fluctuations for the functioning of EMU as an optimum currency area.

We first present our results for relative prices. We estimate our panel equation for the EMU period only (1999-2016), because the loss of exchange rates has fundamentally changed the working of relative prices (Biroli et al., 2010).²⁰ The results with GLS (table 3.7) and GMM (table 3.8) are relatively comparable and in line with expectations.²¹ First, we find a relatively strong

²⁰ A quick comparison of estimations for the EMU-period and for the period before suggests that EMU has lead to i) a strong increase in the persistence of price changes, ii) a decline in the speed of mean-reversion, iii) a lower response to differences in output gaps and iv) a strong increase in the R-squared of the regression, due to the absence of exogenous exchange rate disturbances. These results are available upon request.

²¹ Compared to the GLS estimations, the persistence seems to be slightly lower in the GMM estimations, while the estimated mean reversion is a bit stronger. We also find slightly higher coefficients for the relative output gap.

persistence of changes in relative prices in all specifications. We also find a significant negative coefficient for the (lagged) level or the real effective exchange rate. This suggests that relative prices show mean reversion and that deviations in competitiveness are corrected, albeit relatively slowly. Finally, the coefficients for the various relative output gaps are positive and in most cases significant. Hence, as expected positive asymmetric fluctuations trigger an increase in relative prices.

Table 3.7. Regressions relative price - GLS

	short-term			medium-term	
	(1)	(2)	(3)	(4)	(5)
c	0.12**	0.10**	0.13**	0.20**	0.26**
$\Delta reer_{t-1, \dots, t-4}$	0.85**	0.78**	0.85**	0.78**	0.77**
$reer_{t-1}$	-0.027**	-0.021**	-0.027**	-0.043**	-0.056**
$gap_{i,t-1} - gap_{EMU,t-1}$					
short-term GDP gap	0.09**				
short-term EC gap		0.14**			
short-term DD gap			0.02		
medium-term GDP gap				0.08**	
medium-term DD gap					0.07**
R^2	0.93	0.92	0.93	0.94	0.94
partial R^2 gap	0.005	0.042	0.001	0.076	0.087
#observations	748	748	748	748	748

Note: * is 5% significance, ** is 1% significance. Panel regressions with quarterly data for 11 EMU countries in the period 1999-2016, using weighted least squares (GLS) with country weights, country fixed effects and White robust standard errors. The partial R^2 is calculated as the share of the variation in relative prices explained by the respective short-term and medium-term output gaps (see section 3.3.3).

The results show that medium-term fluctuations explain much more of the changes in relative prices in the euro area than short-term fluctuations.²² In the GLS estimations, short-term fluctuations explain only a very small fraction of the relative price changes, although the output gap of the European Commission does slightly better than the other two (table 3.7). The explanatory power of medium-term fluctuations is clearly higher, at 8% for medium-term fluctuations in GDP and almost 9% for medium-term

²² As mentioned, we have calculated the explanatory power of each of the fluctuations with the partial R^2 . In the calculation, we have incorporated one year of extra feedback via the persistence in relative price changes.

Table 3.8. Regressions relative price - GMM

	short-term			medium-term	
	(1)	(2)	(3)	(4)	(5)
<i>c</i>					
$\Delta reer_{t-1,...,t-4}$	0.67**	0.64**	0.66***	0.63**	0.61**
$reer_{t-1}$	-0.078**	-0.066**	-0.078**	-0.13**	-0.16**
$gap_{i,t-1} - gap_{EMU,t-1}$					
short-term GDP gap	0.11**				
short-term EC gap		0.24**			
short-term DD gap			0.07**		
medium-term GDP gap				0.18**	
medium-term DD gap					0.16**
<i>R</i> ²					
<i>partial R</i> ² <i>gap</i>	0.006	0.112	0.004	0.308	0.370
<i>#observations</i>	748	748	748	748	748

Note: * is 5% significance, ** is 1% significance. Panel regressions with quarterly data for 11 EMU countries in the period 1999-2016, using GMM with first-differences for the instrument weighting matrix (Arellano-Bond) and White standard errors. We use as internal instruments the lagged values of the real effective exchange rate and the output gap. The partial R_2 is calculated as the share of the variation in relative prices explained by the respective short-term and medium-term output gaps (see section 3.3.3).

fluctuations in domestic demand. The results with GMM show an even more pronounced difference (table 3.8). Again the explanatory power of the short-term fluctuations is very low, while the Commission gap does better. But also here the explanatory power of medium-term fluctuations is significantly higher: 31% for medium-term GDP-fluctuation and 37% for the medium-term domestic demand fluctuations.

To see what this means in practice, we relate the estimated effects of the short-term and medium-term GDP fluctuations to the actual changes in relative prices. We calculate the effects of the output gaps by multiplying the relative gaps with their coefficient (taken from the GMM estimation), and including four quarters of feedback via the persistence of relative prices. We cumulate the relative changes over two longer periods: the period in the runup to the crisis (1999-2007) and the period afterwards (2008-2016). Our calculations clearly confirm that medium-term fluctuations explain a much larger share of the cumulative changes in relative prices (figure 3.13). The

Figure 3.13. Contribution of short-term and medium-term fluctuations to changes in relative prices

Note: the blue dots represent the actual cumulative change in relative prices over the relevant period. The bars represent the cumulated contributions of the respective short- and medium-term output gaps to this change in relative prices. These contributions are calculated as the output gap measure over the relevant period multiplied by their coefficient taken from the GMM estimation (table 3.8 above).

contribution of short-term fluctuations is almost negligible: the orange bars are barely visible for most countries. Medium-term fluctuations explain a much larger part of the changes, especially before the crisis. In 1999-2007, medium-term fluctuations explain the large divergence in relative prices between on the one hand Germany and on the other hand Greece, Spain and Ireland. After the crisis (2008-2016), medium-term fluctuations also explain a larger part of the price changes than short-term fluctuations, although the overall pattern is somewhat less clear.²³

Current accounts and capital flows

We now present estimates for current account balances for the period 1995-2016. In the GLS estimation, all coefficients are significant, while most of the coefficients have the expected sign (table 3.9).²⁴ Importantly, price competitiveness has the expected negative coefficient: an increase in relative prices tends to lower the current account balance. All output gaps also have the expected negative coefficient, suggesting that an increase in the output gap worsens the current account balance. The regressions using GMM show very similar results, although the significance of individual coefficients tends to be lower (table 3.10).

Again, the results show that medium-term fluctuations explain a much larger share of the evolution of current account balances in the euro area than short-term fluctuations. In the GLS-estimations, short-term fluctuations explain only a small fraction of the variation in current account balances, varying from less than 1% for the bandpass-filtered gaps to around 6% for the Commission gap. The explanatory power of medium-

²³ The estimated effect of the medium-term fluctuations is relatively small in several countries. This may be because it may take a while before the large positive output gaps in Southern Europe turn negative, and because even then it may take time before relative prices are affected because of the persistence of relative price changes.

²⁴ There are two exceptions. First, the coefficient for the old-age-dependency ratio is positive, which suggests that in contrast with expectations, countries with a more aged population tend to save more, not less. Second, the coefficient for country-specific external demand is negative, which suggests that countries with the highest external demand growth have lower current account balances.

Table 3.9. Regressions current accounts - GLS

	short-term			medium-term	
	(1)	(2)	(3)	(4)	(5)
c	-35.6**	-67.2**	-35.8**	-159.0**	-207.3**
fd_t	-0.11**	-0.14**	-0.11**	-0.20**	-0.22**
b_t	0.07**	0.16**	0.08**	0.25**	0.29**
$reer_t$	-0.13**	-0.18**	-0.13**	-0.08**	-0.03**
gap_t					
short-term GDP gap	-0.14*				
short-term EC gap		-0.44**			
short-term DD gap			-0.25**		
medium-term GDP gap				-0.37**	
medium-term DD gap					-0.45**
$gdp/capita_t$		0.09**	0.04**	0.18**	0.23**
Δpop_t		-1.81**	-2.84**	-2.06**	-0.88**
$dep.ratio_t$		0.68**	0.73**	0.61**	0.41**
R^2	0.77	0.80	0.77	0.81	0.83
$part.R^2.gap$	0.001	0.059	0.007	0.168	0.401
$part.R^2.reer$	0.044	0.083	0.043	0.017	0.003
#observations	903	903	903	903	903

Note: * is 5% significance, ** is 1% significance. Panel regressions with quarterly data for 11 EMU countries in the period 1995-2016, using weighted least squares (GLS) with country weights, country fixed effects and White robust standard errors. The partial R2 is calculated as the share of the variation in current account balances explained by the respective short-term and medium-term output gaps (see section 3.3.3).

term fluctuations is much higher, at almost 17% for the medium-term GDP gap and even 40% for the medium-term domestic demand gap. The results for the GMM estimations are comparable, although the overall explanatory power is slightly lower: medium-term GDP-fluctuations explain around 11% of current account balances, and medium-term domestic demand fluctuations around 30%.

Another interesting result is that the inclusion of medium-term instead of short-term output gaps tends to lower the coefficients and the explanatory power of relative price competitiveness. In the GLS-regressions with short-term fluctuations, relative prices explain between 4 and 8% of the variation in current account balances, which underlines the importance of competitiveness within the euro area. However, in the regression with medium-term fluctuations, the explanatory power of price competitiveness is much

Table 3.10. Regressions current accounts - GMM

	short-term			medium-term	
	(1)	(2)	(3)	(4)	(5)
c					
fd_t	-0.05	-0.05	-0.01	-0.19*	-0.19*
b_t	0.13	0.18*	0.11*	0.24*	0.22**
$reer_t$	-0.03	-0.07	-0.03	-0.01	0.01
gap_t					
short-term GDP gap	-0.04				
short-term EC gap		-0.24**			
short-term DD gap			-0.19**		
medium-term GDP gap				-0.29**	
medium-term DD gap					-0.39**
$gdp/capita_t$	-0.07	-0.06	-0.09	0.11	0.16**
Δpop_t	-1.74*	-1.02	-1.30	-1.77	-0.01
$dep.ratio_t$	1.39*	1.18*	1.20*	1.04*	0.60
R^2					
$part.R^2.gap$	0.000	0.017	0.004	0.105	0.303
$part.R^2.reer$	0.001	0.011	0.002	0.00	0.00
$\#observations$	892	892	892	892	892

Note: * is 5% significance, ** is 1% significance. Panel regressions with quarterly data for 11 EMU countries in the period 1995-2016, using GMM using GMM with first-differences for the instrument weighting matrix (Arellano-Bond) and White standard errors. We use as internal instruments the lagged values of the real effective exchange rate and the output gap. The partial R^2 is calculated as the share of the variation in current account balances explained by the respective short-term and medium-term output gaps (see section 3.3.3).

lower and even almost disappears. This underlines results by Gaulier and Vicard (2012) and Comunale and Hessel (2014) that suggest that the current account deficits in EMU are not only driven by losses in price competitiveness, but are also due to medium-term fluctuations in GDP and domestic demand related to the financial cycle.²⁵

We again try to see what this means in reality. We plot the actual current account balances against the contributions of short and medium-term fluctuations in GDP to these imbalances (figure 3.14). The contributions are calculated with the coefficients of the GLS estimation. Short-term fluctua-

²⁵ However, it is difficult to draw too strong conclusions from our results in terms of causality, because there seems to be a strong medium-term co-movement in gdp-gaps, relative prices and current account balances.

tions are a poor explanation for the evolution of current accounts (the dotted black lines in figure 3.14). They consistently predict changes in current accounts that are small and short-lived. The medium-term fluctuations do a much better job (the solid black lines in figure 3.14). They predict differences in current account balances that are much larger and much more persistent than short-term fluctuations. Moreover, they do a really good job in explaining the direction of changes in the current account balance. The model with medium-term fluctuations provides the best fit for Greece, Spain and Ireland, where the financial boom and bust was accompanied by a worsening and subsequent improvement in current accounts. The same holds for Portugal and Italy, where the model predicts a more or less stable current account deficit before the crisis, and an improvement subsequently. And while the model cannot fully explain the level of the current account surplus for the Netherlands, it does seem to explain its changes over time surprisingly well.²⁶

Fiscal policy

Finally, we present the estimations for budget balances for the period 1995-2016. A priori, we expect it to be more difficult to obtain clear results for the effects of medium-term fluctuations on budget balances for two reasons. First, it is well-established that budget balances are closely linked to short-term fluctuations. Second, even if medium-term fluctuations have an influence on fiscal outcomes, this may not necessarily translate into consistent effects on the budget balance over the whole sample. For example, medium-term fluctuations may lead to higher temporary revenues that are spent and hence do not improve the budget balance. The effects of the medium-term cycle may therefore only show up during certain periods, such as an un-

²⁶ Interestingly, the model does not fit developments in Germany and Finland well. In Germany, the model predicts a worsening of the current account after the crisis, but in reality the surplus even improved further, possibly due to strong demand for German products in other parts of the world. The model predicts an increase in the Finnish current account after the crisis, but in reality the current account worsened considerably. This suggests that Finland was hit by a negative competitiveness shock, which may be related to the demise of Nokia.

Figure 3.14. Contribution of economic fluctuations to evolution of current account balances

Note: the grey lines represent the actual current account balance as a percentage of GDP. The dotted black lines and solid black lines represent the contributions of the short- and medium-term output gaps to the evolution of the current account balances. These contributions are calculated as the output gap measure multiplied by their coefficient taken from the GLS estimation (table 3.9 above).

usually strong decline in budget balances during downturns (Gilbert and Hessel, 2014).

Table 3.11. Regressions budget deficits - GLS

	short-term			medium-term	
	(1)	(2)	(3)	(4)	(5)
c	-2.73**	-4.86**	-2.72**	-3.37**	-2.96**
b_{t-4}	0.73**	0.59**	0.75**	0.72**	0.73**
d_{t-4}	0.03**	0.04**	0.03**	0.03**	0.03**
i_t	-0.05	0.08	-0.04	0.01	-0.00
fri_t	-0.30**	0.16*	-0.29**	-0.27**	-0.27**
gap_t					
short-term GDP gap	0.38**				
short-term EC gap		0.49**			
short-term DD gap			0.29*		
medium-term GDP gap				0.05*	
medium-term DD gap					0.012
R^2	0.71	0.80	0.69	0.68	0.68
$part.R^2.gap$	0.017	0.113	0.014	0.005	0.000
$\#observations$	840	840	840	840	840

Note: * is 5% significance, ** is 1% significance. Panel regressions with quarterly data for 11 EMU countries in the period 1995-2016, using weighted least squares (GLS) with country weights, country fixed effects and White robust standard errors. The partial R^2 is calculated as the share of the variation in budget balances explained by the respective short-term and medium-term output gaps (see section 3.3.3).

These difficulties are visible in the results for the GLS estimation (table 3.11). As expected, we find a strong persistence of the budget balance, as well as an upward effect of the debt ratio (as more debt increases interest payments). The effect of the interest rate is not statistically significant, while the coefficient of the fiscal rules index varies in sign. The various output gaps have the expected positive sign, but the coefficients for medium-term fluctuations are small and not always significant. The GMM-estimation provides better results, with more variables significant and generally higher coefficients for the output gap variables (table 3.12).²⁷

The results reveal that medium-term fluctuations do have some value

²⁷ In line with Bénétrix and Lane (2015) we also ran regressions for public revenues and public expenditures separately (both expressed as growth rates and as a percentage of GDP). The effects of the medium-term fluctuations were not clearly visible in these regressions either.

Table 3.12. Regressions budget deficits - GMM

	short-term			medium-term	
	(1)	(2)	(3)	(4)	(5)
c					
b_{t-4}	0.64**	0.53**	0.66**	0.72**	0.72**
d_{t-4}	0.05**	0.10**	0.06**	0.12**	0.12**
i_t	-0.18**	0.09**	-0.16**	-0.05**	-0.06**
fri_t	-0.71**	0.09	-0.76**	-1.29**	-1.24**
gap_t					
short-term GDP gap	0.58**				
short-term EC gap		0.73**			
short-term DD gap			0.36**		
medium-term GDP gap				0.24**	
medium-term DD gap					0.18**
R^2					
$part.R^2_{gap}$	0.041	0.255	0.021	0.102	0.094
$\#observations$	840	840	840	840	840

Note: * is 5% significance, ** is 1% significance. Panel regressions with quarterly data for 11 EMU countries in the period 1995-2016, using GMM with first-differences for the instrument weighting matrix (Arellano-Bond) and White standard errors. We use as internal instruments the lagged values of the output gap and the debt ratio. The partial R^2 is calculated as the share of the variation in budget balances explained by the respective short-term and medium-term output gaps (see section 3.3.3).

added compared to short-term fluctuations, but that the evidence is somewhat mixed. In the GLS-estimations, short-term fluctuations have a reasonable explanatory power, varying from 1-2% for the bandpass-filtered gaps to 11% for the European Commission's output gap. However, in this specification the explanatory power of medium-term fluctuations is lower than of short-term fluctuations. The results for the GMM-estimation reveal that medium-term fluctuations do have some value added compared to short-term fluctuations (table 3.12). The partial R^2 for the short-term fluctuations ranges from 2-4% for the bandpass to 26% for the Commission output gap. While no medium-term fluctuation performs better than the Commission gap, they do consistently outperform the bandpass-filtered short-term fluctuations. Both medium-term gaps explain around 10% of the variation in budget balances.

To see what this means in practice, we compare which fluctuations bet-

Figure 3.15. Contribution short and medium-term gap to change in budget balance

Note: the dots represent the actual change in the budget balance over the relevant period (in percentage points of GDP). The bars represent the contributions of the respective short- and medium-term output gaps to this change in the budget balance. This contribution is calculated as the output gap measure over the relevant period multiplied by their coefficient taken from the GMM estimation (table 3.12 above).

ter explain the budgetary deterioration after the financial crisis. We focus on the change in the budget balance between the second half of 2007 (just before the crisis) and the second half of 2011 (figure 3.15). As Gilbert and Hessel (2014) point out, the deterioration in public finances differs considerably from country to country (figure 3.15). Short-term fluctuations cannot explain these differences, as the short-term output gaps are relatively similar (the striped bars in figure 3.15). Medium-term fluctuations do a better job. The medium-term GDP gap explains why budgetary deteriorations are larger and more persistent in Spain, Finland, Ireland Portugal and the Netherlands. Even though budget deficits are to an important extent driven by short-term fluctuations, only the medium-term fluctuations are able to explain why the deterioration of budget deficits after the crisis was so much larger and so much more persistent in some countries than in others. This confirms the results of Eschenbach and Schuknecht (2004) and Bénétrix and

Lane (2015). That said, additional research seems necessary on how and when medium-term fluctuations exactly affect public finances.

Summary

We conclude this section by summarizing the previously presented explanatory power of medium- and short-term fluctuations for all three imbalances (table 3.13). It clearly emerges that the evolution of imbalances in the euro area is more closely connected to medium-term fluctuations than to short-term fluctuations. This finding holds most firmly for the developments in relative prices and in current account balances, but to a lesser extent also applies to the evolution of budget balances.

Table 3.13. Explanatory power short and medium-term fluctuations

	method	short-term			medium-term	
		GDP	DD	EC	GDP	DD
Relative prices	GLS	0.005	0.001	0.042	0.076	0.087
	GMM	0.006	0.004	0.112	0.308	0.370
Current account balances	GLS	0.001	0.007	0.059	0.168	0.401
	GMM	0.000	0.004	0.017	0.105	0.303
Budget balances	GLS	0.017	0.014	0.113	0.005	0.000
	GMM	0.041	0.021	0.255	0.102	0.094

Note: summary table of the partial R^2 for short-term and medium-term output gaps in regressions for euro area imbalances performed with GLS and GMM (internal instruments). The partial R^2 is calculated as the share of the variation in budget balances explained by the respective output gaps (see section 3.3). The partial R^2 in this table are taken from tables 3.7-3.12 above.

Our findings suggest that the buildup and correction of imbalances in the period surrounding the sovereign debt crisis has been a medium-term phenomenon, and that medium-term fluctuations are relevant for the functioning of EMU as an optimum currency area.

3.6 Conclusions and policy implications

We have looked at medium-term fluctuations in EMU and reach five conclusions. First, we find that medium-term fluctuations in the euro area are much larger and much less symmetric than short-term fluctuations. Second, short-term fluctuations became smaller and more symmetric, but medium-term fluctuations became larger and less symmetric. Third, while short-term fluctuations in EMU are more symmetric than in the US, medium-term fluctuations are less symmetric. Fourth, differences in medium-term fluctuations in the euro area have become more strongly correlated with financial variables like credit and house prices, and less strongly correlated with real variables like productivity. Finally, medium-term fluctuations are more closely related to imbalances in price competitiveness, current accounts and budget deficits than short-term fluctuations.

We draw several policy implications. First, medium-term fluctuations add a relevant dimension for the functioning of EMU as an optimum currency area. This dimension has become more important due to the increasing role of financial factors and financial cycles, which heightens the risk that medium-term fluctuations go together with macro-financial imbalances and crises. We also find that not only differences in the *phase* of medium-term fluctuations matter, but also differences in the *amplitude* of these fluctuations - which can be both substantial and persistent. While medium-term fluctuations were relatively synchronized in the EMU-period, their amplitudes varied widely, possibly because member states reacted very differently to the loose financial conditions before the crisis. Our medium-term perspective therefore leads to a less benign view on the functioning of EMU as an optimum currency area, that seems more in line with the sovereign debt crisis. Our perspective also casts doubt on the idea that EMU has endogenously become closer to an optimal currency area. Since the start of the euro, medium-term fluctuations have been larger and less symmetric than before.

Second, our results suggest that the asymmetric medium-term fluctua-

tions in EMU result from the complex interaction of several factors. These include a period of rapid rapid financial integration that had asymmetric effects due to differences in economic and in financial development and financial systems between member states. These effect have been amplified because several member states had economic structures that were not able to cope with financial divergences, due to structural rigidities, insufficient adjustment mechanisms and in some cases lack of policy discipline. Deficiencies in the institutional setup of the monetary union have added to the problem, for instance via the lack of instruments to contain crises and capital flight. The interaction of these real, financial and institutional channels has led to medium-term fluctuations and the related buildup and correction of macro-economic imbalances in the euro area. However, more research seems necessary to determine the relative importance of these factors.

Third, our results underline that financial factors deserve sufficient attention in the debates on EMU. Financial factors had been largely missing from macroeconomic paradigms before the financial crisis, and also hardly featured in the debates on EMU. The Maastricht Treaty was directed at *nominal* factors with the aim to contain inflation, while the theory of optimum currency areas focused on *real* factors like wage flexibility and labour mobility. Neither of these approaches had anticipated (fully) how financial factors could lead to medium-term fluctuations, macroeconomic imbalances and crises, and hence also affected the real side of the economies in the monetary union. Attempts to further improve the functioning of EMU should therefore not only focus on real measures, like structural reforms, but also on financial measures, like macroprudential policy, the banking union and other aspects of financial regulation. A question for further research is how these financial factors should be incorporated more systematically into the theory of optimum currency areas. For example, it could be argued that the degree and the nature of financial integration in a monetary union should be criteria in the OCA theory.

A final implication is that the medium-term dimension should be

strengthened in the setup of the monetary union. So far, both the theory of optimum currency areas and existing mechanisms to deal with asymmetric fluctuations (the Stability and Growth Pact) focus on the short term. Since the financial crisis, the medium-term dimension has been strengthened with the Macroeconomic Imbalances Procedure (MIP) and macroprudential policy frameworks. However, more can be done. In monetary policy, longer horizons would allow central banks to implement leaning against the wind policies during booms, and pay (more) attention to negative side effects of long periods of loose monetary policy during downturns. Fiscal policy should more explicitly take into account the budgetary consequences of financial cycles, both during the boom and busts. This calls for larger buffers during booms, and for more robust indicators like (long-term) expenditure growth instead of cyclically adjusted budget balances. At the same time, the presence of medium-term fluctuations may make some measures to strengthen EMU more controversial. In these circumstances, further increases in public risk sharing, such as a budgetary stabilisation fund, are more likely to lead to politically sensitive permanent redistribution between member states.

Chapter 4

Are European sovereign bonds fairly priced? The role of modelling uncertainty*

4.1 Introduction

Developments of bond yields are an issue for monetary policy as its effectiveness depends on the transmission of money market rates into long-term bond yields (Coeuré, 2012). Disorderly market conditions can disturb this mechanism, if they go in tandem with excessive volatility in bond yields. Strong swings in bond yields may be due to (fair) changes in required compensation for credit risk, market volatility and liquidity tensions. However, during periods of high market turmoil, bond yields may also reflect risks associated with excessive risk aversion that is out of sync with economic fundamentals and market conditions.

Occasionally this may have been the case during episodes with extreme

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stress in European bond markets (Figure 4.1). At the peak of the debt crisis - in the summer of 2012 - government bond markets were thought to be severely distorted due to investors' fears on the reversibility of the euro (ECB, 2012). They took into account redenomination risk and this led to self-reinforcing upward spirals in bond yields. The disorderly market conditions threatened the singleness of the ECB's monetary policy and the transmission of the policy stance to the real economy. This increased the risk of funding shortages for governments in the periphery of the euro area and for European banks that had large amounts of government bonds on their balance sheets (Allen and Moessner, 2013). At the time, several peripheral countries experienced sudden stops in external financing, which were reflected in the accumulation of large imbalances in the TARGET2 settlement system (Merler and Pisani-Ferry, 2012).

Figure 4.1. Government bond yields

In response to the disruptions in the monetary transmission mechanism, the ECB announced Outright Monetary Transactions (OMTs) in secondary markets for sovereign bonds in the euro area. Under appropriate conditions the OMTs are intended to be an effective backstop to avoid destructive scenarios with potentially severe challenges for price stability. The ECB does not target a specific yield level with OMTs, but considers a range of vari-

ables in planning any interventions (ECB, 2012). The level of yield ceilings, but also risk spreads, market liquidity conditions and measures of volatility will be considered. Such variables may indicate whether government bond markets are distorted and bonds mispriced.

The announcement of OMTs has arguably contributed greatly to the decline of intra-EMU bond spreads since the summer of 2012. Yet OMTs are not uncontroversial among policymakers, even within the ECB Governing Council. While some see OMTs as “probably the most successful monetary policy measure undertaken in recent times” (Draghi, 2013b), others remind that money creation – which could result from the use of OMTs – has been a policy advice from Mephistopheles in Goethe’s *Faust* (Weidmann, 2012).

One important reason for these differences is the lack of consensus among policymakers on the exact nature of the fragilities in European bond markets (De Grauwe and Ji, 2013b). On one end of the spectrum, some see higher spreads as a rational reaction to increased insolvency risk due to deteriorating fundamentals (e.g., Issing, 2009). In this vision, financial support via loans from the EFSF/ESM or via ECB interventions carry large financial risks, while they also create moral hazard because the disciplining effect of financial markets is reduced (Benink and Huizinga, 2013). On the other end of the spectrum, some argue that higher spreads result from overshooting financial markets, where fear and panic can drive spreads away from fundamentals (e.g., De Grauwe and Ji, 2013a; Giavazzi et al., 2013). In this view, liquidity support is justified especially as self-fulfilling expectations could turn liquidity problems into solvency problems (De Grauwe, 2012a).

For policy makers, it is therefore very important to know whether and to what extent sovereign yields of euro countries are misaligned compared to fundamentals. The answer to this question determines whether market discipline can be relied on, or whether financial markets fail and support or interventions by the EFSF/ESM or ECB are needed. The answer is there-

fore not only relevant to assess the (future) policy of the ECB, but it also influences the future institutional design of EMU (Gilbert et al., 2013).

The research question of this paper is the extent to which the large swings of sovereign yields of several euro area countries since 2010 can be attributed to fundamentals, given the inherent model uncertainty. Yet a definite answer to the research question is not straightforward. Fundamental values of financial market variables are inherently uncertain. In addition, bond yields may react in a rational way to political risks, such as government ineffectiveness in member states, indecisiveness at the European level, political discussions about debt restructuring and private sector involvement, or open speculation about the possibility of a euro-exit. Yet these aspects – including redenomination risks – are very difficult to quantify. Finally, recent research suggests that the reaction of bond yields to fundamentals is time-varying, due to fluctuations in global risk aversion (D’Agostino and Ehrmann, 2013). This time variability has probably been even stronger in the euro area, where bond yields hardly diverged between 1999 and 2008, but started to differ widely during the sovereign debt crisis. This unusual behavior of bond spreads poses important modelling challenges.

Rather than providing a final answer, we therefore emphasize the role of model uncertainty. This aspect is greatly underemphasized in the recently booming literature that explains bond yields from macroeconomic fundamentals. We adopt the approach taken in this literature and estimate reduced form models for bond yields. This modelling choice is motivated by the question of whether bond yields are fairly priced with respect to macroeconomic fundamentals and market conditions. The purpose of this paper is to show the effect of model uncertainty when assessing whether sovereign bond yields are aligned with macroeconomic fundamentals. We do not aim at estimating the yield curve, so we refrain from estimating stochastic models, such as models that predict the yield curve of tomorrow by using to-

day's observed yield data (see, for instance, Nelson and Siegel, 1987).¹ We are also not looking for the dynamics of impulse responses of bond yields to developments of fundamental variables, such as studies that use Vector Autoregressive models do (see Arezki et al., 2011). Finally, we are not looking for contagion or spill-over effects from one country to another, as e.g. Mink and De Haan (2013) have done (see further Section 4.2).

We give several examples of how modelling choices affect the extent of misalignment of sovereign bond yields. Misalignment occurs if the actual yield is outside the confidence band of the model's predictions. Schematically, in Figure 4.2, the red area is considered to be statistically significant evidence of overpricing, the green area of underpricing.² We compare actual yields with in-sample prediction intervals, as the policy relevant research question is whether actual yields are misaligned with fundamentals, not what future yields will be.³

Our main conclusion is that bond yields do display large fluctuations that cannot be explained by macroeconomic fundamentals. At the same time, the extent to which bond yields are misaligned is highly uncertain, and should therefore be interpreted with great caution.

The remainder of this paper is structured as follows. Section 4.2 provides an overview of the empirical literature on sovereign bond yields and derives five major modelling choices. Section 4.3 presents our benchmark model and various alternative specifications, while Section 4.4 offers a description of the data. Section 4.5 presents estimates of the benchmark model after which Section 4.6 shows how alternative modelling choices affect the results. Section 4.7 concludes.

¹ A related strand of literature incorporates macroeconomic factors into yield curve models (Hördahl et al., 2006).

² Strictly speaking, overpricing of an asset implies that the yield is lower than its fundamental level. However, for the sake of simplicity and because this paper focuses on yields instead of asset prices, with overpricing we mean that the yield is higher than its fundamental level.

³ *Ceteris paribus*, confidence bands are wider for model forecasts than for model predictions.

Figure 4.2. Overpricing and underpricing

4.2 Literature review

This section first summarizes the main findings of the empirical literature on sovereign yields, after which it focuses on the wide diversity in sample selection and modelling choices.

4.2.1 Main findings

There is an extensive and fastly growing body of empirical literature on sovereign yields. The European sovereign debt crisis has clearly increased the interest in this subject. Roughly three relevant findings seem to emerge, even though there is no consensus.⁴

First, the reaction of financial markets is not constant over time. Spreads were exceptionally low during the first decade of EMU (Bernoth et al., 2012;

⁴ Gilbert et al. (2013) provide a more elaborate overview of these three findings.

Pogoshyan, 2012; Beirne and Fratzscher, 2013; D'Agostino and Ehrmann, 2013) and only started to increase after the start of the debt crisis. This was partly due to an increase in global risk aversion (Haugh et al., 2009; Caceres et al., 2010; Aizenman et al., 2013b), but spreads also reacted more strongly to fiscal fundamentals (Haugh et al., 2009; von Hagen et al., 2011; Bernoth et al., 2012; Bernoth and Erdogan, 2012; Giordano et al., 2013; Beirne and Fratzscher, 2013; D'Agostino and Ehrmann, 2013).

Second, EMU member states appear more vulnerable than countries having their own currencies. Spreads in the so-called 'periphery' of the euro area (Greece, Ireland, Italy, Portugal and Spain) are higher than in countries with comparable fiscal fundamentals (De Grauwe and Ji, 2013a; Poghosyan, 2012; D'Agostino and Ehrmann, 2013), even if emerging economies are included in the sample (Aizenman et al., 2013b). This is partly a rational reaction to specific vulnerabilities, such as the lack of the exchange rate as an adjustment mechanism and the large banking sectors with high shares of sovereign debt on their balance sheets (Pisani-Ferry, 2012). But EMU member states could also be more vulnerable to bond yield misalignment. The exceptionally high level of financial integration has made countries more sensitive to contagion (Forbes, 2012), while the single currency may have increased the elasticity of capital flows with respect to fundamentals (Lane, 2012). Finally, EMU countries do not have their own central bank that can act as a lender of last resort once the government is faced with liquidity problems (De Grauwe, 2012a).

Third, several studies find evidence that financial markets have been overshooting at times, especially in the latter phase of the debt crisis. Spreads in the periphery of the euro zone were higher than could be explained on the basis of fiscal fundamentals. The evidence of mispricing continues to hold when other economic fundamentals are included, such as current account balances (De Grauwe and Ji, 2013a), potential growth (Poghosyan, 2012), private debt (Giordano et al., 2013) and indicators of financial sector problems (Di Cesare et al., 2012). In addition, yield spreads

seem very persistent, which may imply that the mispricing is long lasting (Giordano et al., 2013; De Grauwe and Ji, 2013a) and possibly that “markets can stay irrational longer than a country can stay solvent” (Favero and Missale, 2012).

However, on closer inspection, the consensus on mispricing disappears. First, there is no consensus on whether certain model specifications include mispricing. For example, Bernoth and Erdogan (2012) and D’Agostino and Ehrmann (2013) see the stronger reaction of spreads to (fiscal) fundamentals during the crisis period as a normal phenomenon, not as misalignment. According to Giordano et al. (2013) and Beirne and Fratzscher (2013), the stronger reaction to spreads during the crisis is a form of “wake-up call contagion”. They also tend to see this as a normal phenomenon that doesn’t imply mispricing, but Giordano et al. (2013) add “assessing whether the extent of such a “wake up” is appropriate or excessive is not straightforward and [...] outside the scope of this paper”. By contrast, Favero and Missale (2012) see their contagion measure – a weighted average of spreads in countries with comparable fundamentals – as a sign of misalignment. Second, there is no agreement on the causes. De Grauwe and Ji (2013a) emphasize self-fulfilling expectations that could lead to inherent instability. Favero and Missale (2012) and Giordano et al. (2013) point at contagion from other countries, while Di Cesare et al. (2012) see a perception of euro area break-up risk. By contrast, Steinkamp and Westermann (2012) point at the increasing share of loans with (implicit) senior credit status. Third, there is no consensus on the size and importance of mispricing. While De Grauwe and Ji (2013a) find “systemic mispricing of sovereign risk”, Beirne and Fratzscher (2013) claim that “a deterioration in [...] fundamentals and [...] a sharp rise in the sensitivity of [...] markets to fundamentals are the main explanations”. For Portugal, Poghosyan (2012) finds strong overpricing while Giordano et al. (2013) find none. More research seems to be necessary to determine the size and nature of misalignment more precisely.

4.2.2 Sample selection and modelling choices

Sample selection and modelling choices differ widely between the studies. In itself, this may reflect high model uncertainty. It seems plausible that modelling choices affect the size and nature of the mispricing found. This is especially the case when mispricing is defined as the size of the residuals generated by the model, or the part of the spreads that cannot be explained by the fundamentals. This approach is used in various studies (De Grauwe and Ji, 2013a; Pogoshyan, 2012; Giordano et al., 2013; Di Cesare et al., 2012; D'Agostino and Ehrmann, 2013).⁵

In this study we pay attention to a number of aspects of modelling uncertainty that deserve particular attention when addressing the central question at hand, i.e. whether sovereign yields can or cannot be explained by fundamentals or, in other words, whether there is over or underpricing in sovereign bond markets. Looking at the literature, five aspects of model uncertainty may be specifically relevant. These aspects are mutually dependent: the importance of choices on one aspect may depend on the choices made on the other aspects.⁶ We will show below that the modelling choices that are made in the end cannot be justified on the basis of econometric diagnostics alone. They also require a fair bit of economic judgment.

1. The first aspect relates to the *statistical uncertainty* with respect to the econometric estimation of any model. When standard deviations of estimated model coefficients are large, the resulting uncertainty with respect to the model predictions should be taken into account. This is especially relevant when mispricing is defined as the part of the spreads

⁵Other studies use various kinds of measures for contagion, such as ratings (Arezki et al., 2011; Aizenman et al., 2013a; De Santis, 2012), economic news from other countries (Mink and De Haan, 2013; Zoli, 2013), some measure of spreads in other countries (Caceres et al., 2010; Favero and Missale, 2012; Metiu, 2012) and a crisis dummy to measure "wake-up call" contagion (Giordano et al., 2013; Beirne and Fratzscher, 2013). However, not all of these contagion effects necessarily imply that spreads have been overshooting (see also Forbes, 2012).

⁶For example, D'Agostino and Ehrmann (2013) show that the amount of overpricing that is found becomes more sensitive to the sample period if the model does not contain time-dependent variables. By the same token, the choice of countries in the sample only matters if the estimation is done in a panel modelling setting.

that cannot be explained by the fundamentals. In this case, it is essential that the confidence bands of the prediction are taken into account. In several studies, such as Giordano et al. (2013) and De Grauwe and Ji (2013a), this aspect of model uncertainty is not mentioned explicitly. An exception is D'Agostino and Ehrmann (2013).

2. The second aspect is related to the assumptions with respect to *parameter heterogeneity* across regions or countries. Two extreme positions can be found in the literature. On the one extreme, panel models are estimated wherein all parameters are assumed to be equal across all countries. On the other extreme, country-specific models are estimated separately for each individual country, resulting in different parameter estimates for each country. Examples of panel model studies are Bernoth et al. (2012), De Grauwe and Ji (2013a) and Poghosyan (2012) and examples of country-specific models are Arezki et al. (2011), Favero and Missale (2012) and D'Agostino and Ehrmann (2013). In between these two extremes are models that allow for parameter differences between regions or country groups, such as some of the models estimated by Beirne and Fratzscher (2013) and Aizenman et al. (2013a). While most studies use panel models, only a few actually test whether the assumption of equal parameters across countries is justified (Arezki et al., 2011; Favero and Missale, 2012; Beirne and Fratzscher, 2013; D'Agostino and Ehrmann, 2013). In these studies, the assumption of parameter homogeneity across countries is generally rejected.⁷

The choices with respect to parameter heterogeneity may also affect the extent of mispricing. From an econometric perspective, homogeneity will generally be rejected because country-specific coefficients differ from each other and allowing for these differences therefore

⁷Of course, the wide-spread use of panel data models is motivated by the wish to exploit both cross-sectional and time dimensions in the data at the same time, and does hardly ever follow from purely statistical grounds.

will yield a better fit. Yet, a search for mispricing doesn't necessarily require the best fit. It may require investigating whether spreads are higher in some countries compared to spreads in other countries with comparable fundamentals, and this can be done more transparently using homogeneous coefficients. There may also be other reasons for homogeneous coefficients, such as the political desire to apply equal criteria to EMU countries when determining whether financial support is justified. At the same time, some cross-country group variation of model coefficients may sometimes be justified. For example, it is possible that government bonds in the periphery of the euro area are priced differently from those in the core.

3. The third aspect relates to *sample selection*, i.e., the sample period and the countries included. Studies differ widely across these dimensions. Regarding the sample period, choices range from the period since the financial crisis (Metiu, 2012; De Santis, 2012, Zoli, 2013) to the period since the start of EMU (among others, Bernoth and Erdogan, 2012; De Grauwe and Ji, 2013a; Beirne and Fratzscher, 2013) and even to the period since 1980 (Poghosyan, 2012). Regarding the countries in the sample, some studies include only one country (Di Cesare et al., 2012; Zoli, 2013), while others concentrate on EMU-countries (for example, Haugh et al., 2009; Bernoth et al., 2012). However, several studies also include countries from outside the euro area, such as EU-countries (Aizenman et al., 2013a), other advanced economies (De Grauwe and Ji, 2013a; Poghosyan, 2012; D'Agostino and Ehrmann, 2013) and emerging markets (Aizenman et al., 2013b; Beirne and Fratzscher, 2013; Aizenman et al., 2013a).

Sample selection may affect the extent of mispricing found, because the econometric estimation methods maximize the fit of the model over the sample period (D'Agostino and Ehrmann, 2013) and (in case of a panel) the countries included in the sample. To determine possible misalignment, it is therefore important that yields in the sample

are more or less "normal" on average. This normality is difficult to identify, given the time variation in the spreads and the cross-country differences. For example, estimation over the crisis period might be biased because spreads were relatively high during that period. On the other hand, estimation over the EMU-period might be influenced by the exceptionally low intra-EMU spreads before the crisis. In fact, the few studies that acknowledge that intra-EMU spreads were too low in the pre-crisis period include either data from before the start of EMU (Bernoth et al., 2012; D'Agostino and Ehrmann, 2013), countries outside EMU (Beirne and Fratzscher, 2013) or both (Poghosyan, 2012).

4. The fourth aspect is related to the incorporation of *financial market indicators* in the model. Many studies include financial market indicators to account for market conditions affecting sovereign yields. The choice of financial market variables varies considerably, but two groups of variables can be distinguished. One group represents changes in global risk aversion. Usually one such global variable is included into the model, which ranges from the VIX index (see, for example, Giordano et al., 2013; Beirne and Fratzscher, 2013; Aizenman et al., 2013a; D'Agostino and Ehrmann, 2013), to US corporate bond spreads (Haugh et al., 2009; Favero and Missale, 2012; Bernoth and Erdogan, 2012), and the TED spread (Aizenman et al., 2013b). Another group of financial market variables aims at representing more structural characteristics of the bond markets of individual countries, in terms of market depth and liquidity. Usually a country-specific variable is included, which varies from an indicator of market size (Haugh et al., 2009; Bernoth et al., 2012; D'Agostino and Ehrmann, 2013) to bid-ask spreads (Bernoth and Erdogan, 2012; Giordano et al., 2013).

The inclusion of financial market variables in a model for sovereign yields could also affect the extent of mispricing found. Financial market variables allow yield spreads to display variation over time (global risk aversion) and across countries (liquidity) that is not

explained by macroeconomic fundamentals alone. To some extent this seems to be justified, since these financial market variables reflect volatility and liquidity risks that are and should be priced in the market. On the other hand, market sentiments may be overly optimistic or pessimistic and therefore the cause of under or overpricing. Several observers claim that global risk aversion was too low before the crisis, while it may have been too high during the most intense phase of the crisis (e.g., Knot and Verkaart, 2013). Likewise, bid-ask spreads could be affected when sovereign yields are under pressure.

5. The final modelling choice is how to deal with the apparent *time variability* in the reaction of yield spreads. Many studies allow for some form of time variability of the parameters. Some even allow the coefficients to change continuously over a certain horizon (D'Agostino and Ehrmann, 2013; Bernoth and Erdogan, 2012). Other studies assume coefficients to remain constant throughout the whole sample period (Poghosyan, 2012; Steinkamp and Westermann, 2012). In between these two extremes are studies allowing for a structural break in several coefficients, for example, due to the financial crisis or the sovereign debt crisis (e.g., Bernoth et al., 2012; Giordano et al., 2013; Beirne and Fratzscher, 2013). Others allow for non-linearities by interacting some variables with risk indicators (Haugh et al., 2009) or adding squared terms of fiscal fundamentals (Bernoth et al., 2012; De Grauwe and Ji, 2013a; Di Cesare et al., 2012). Finally, some studies deal with time variability by incorporating some kind of contagion measure, such as spreads in other countries (Favero and Missale, 2012) or credit ratings (Arezki et al., 2011; Aizenman et al., 2013a).

The extent of mispricing found will also depend on whether and how time-variability is incorporated. The inclusion of time-variability allows for higher coefficients in the period of the sovereign debt crisis, which implies that a larger part of the yield spreads is explained by macroeconomic fundamentals. The specific method of time-variability

also seems to matter. While the incorporation of a crisis dummy only allows coefficients to differ between the crisis and the pre-crisis period, the incorporation of time-varying coefficients allows for some variation within the crisis period. This may be justified to some extent, as the severity of the crisis also varies, for instance, due to political developments. However, too much time variation in the coefficients increases the chance that all yield developments are attributed to fundamentals. There clearly is a trade-off here, which may be hard to determine exactly.

Our contribution is that we show how the above-mentioned aspects of modelling uncertainty affect the extent of mispricing found.

4.3 The benchmark model and some variants

In this section, we first present our benchmark model, and subsequently several alternative specifications that represent modelling uncertainty.

4.3.1 The benchmark model

Based on the preferred habitat theory of the yield curve (Modigliani and Shiller, 1973), we assume that sovereign yields (r_{it}) consist of three components: a risk-free component (rf_{it}), a risk premium (rp_{it}) and a residual term (e_{it}):

$$r_{it} = rf_{it} + rp_{it} + e_{i,t} \quad (4.1)$$

where i denotes the country and t the time period. The risk premium not only compensates for inflation and credit risks, but also for volatility and liquidity risks. The first two risk factors are determined by expectations with respect to the macro-economic fundamentals of a country, the last two

by a country's financial market conditions, i.e. liquidity and volatility, for which investors require a risk premium.

The macro-economic fundamentals, reflecting a country's earning capacity and credit worthiness, include real gdp growth (*gdp*), inflation (*cpi*), the government debt ratio (*debt*) and the current account ratio (*car*). These variables are used in most models that explain sovereign bond yields from macroeconomic fundamentals (see Section 4.2). When available, we use expectations of market participants for these macro-economic fundamentals (Consensus forecasts), because expectations affect market rates in the first place.⁸ Consensus forecasts are forward looking and contain new information in addition to realizations. Ager et al. (2009) and Dovern and Weisser (2011), for example, find empirical evidence that Consensus forecasts are different from realizations especially during periods of pronounced macroeconomic shocks and in situations where forecasters have to learn about large structural shocks. These expectations are relevant for our model, as they may well be another source of market fluctuations. Our sample period, in which a sovereign debt crisis emerged, is typically a period of such structural shocks. By using Consensus forecasts we follow D'Agostino and Ehrmann (2013), who were the first to use such data for the modelling of sovereign yields; they do this for the G7 countries. The advantages of the Consensus forecasts are that, unlike official public forecasts, they have a monthly frequency and reflect the predictions of financial market participants.

For the financial market conditions we use a latent variable (*fin*), capturing volatility and liquidity of government bond markets in individual countries. These factors partly determine the efficiency of the pricing process and thereby the extent to which yields fairly reflect macroeconomic fundamentals. We also interact the financial market conditions variable with

⁸ Following D'Agostino and Ehrmann (2013), we use the debt ratio as explanatory variable and not the government deficit. For our sample including smaller countries, Consensus forecast data for the latter variable are not always available.

government debt (*debt x fin*), assuming that when financial markets are nervous, market participants are more alert with respect to the countries' credit worthiness than they are under normal market conditions (see, for instance, Haugh et al., 2009).

In other words, we assume that any non-linearity in the relation between credit worthiness and sovereign yields may be driven by market conditions. The *benchmark* model reads:

$$r_{it} = \alpha_{0i} + \alpha_1 r_{fit} + \alpha_2 cpi_{it} + \alpha_3 gdp_{it} + \alpha_4 debt_{it} + \alpha_5 (debt_{it} * fin_{it}) + \alpha_6 car_{it} + \alpha_7 fin_{it} + e_{i,t} \quad (4.2)$$

Our priors are: $\alpha_1, \alpha_2, \alpha_4, \alpha_5, \alpha_7 \geq 0$ and $\alpha_3, \alpha_6 \leq 0$. We do not restrict α_1 to be equal to 1, as our proxy for the risk-free rate is the swap rate for the euro area with a maturity of 2 years (10 year maturities are not available). Therefore, the proxy is an imperfect measure for the risk-free rate and the coefficient is expected to be close to but not necessarily equal to 1.

The residual (e_{it}) reflects the effect of market sentiments unrelated to macro-economic and financial market conditions, as in, for example, De Grauwe and Ji (2013a), Pogoshyan (2012) and D'Agostino and Ehrmann (2013). Market sentiments can be excessively pessimistic or optimistic and generate over or underpricing of the interest rate, respectively.

In order to assess whether misalignment of yields has occurred during the crisis, we estimate model (4.2) and compare the model predictions with actual bond rates, taking into account the predictions' 95% confidence bands.

4.3.2 Alternative specifications

We also use several alternative specifications and propose an alternative sample selection. Our aim is to show how these modelling uncertainties may affect the extent of misalignment of bond yields. We consider the five

sources of model uncertainty which have been discussed in Section 4.2.2.

Model uncertainty 1. The use and calculation of confidence bands for the model prediction is a source of model uncertainty.

The search for over or underpricing of sovereign yields essentially implies looking for an omitted variable bias in the regression results. In the present case, the omitted variable could be irrational market optimism or pessimism, which is typically hard to measure. Contagion could be such a variable too. Omission of such variables may result in the residuals being consecutively positive or negative, respectively, depending on whether there is excessive pessimism or optimism in the sovereign bond market. Hence, when there is over or underpricing, by definition, there should be positive or negative autocorrelation of the residuals. OLS estimates for model coefficients in the presence of autocorrelation are unbiased. However, they no longer have the minimum variance property, making confidence intervals and hypothesis tests based on t and F distributions unreliable. Computed variances and standard errors of forecasts may be inaccurate when autocorrelation is not accounted for. Therefore, we report standard errors which are robust to clustering, autocorrelation and heteroscedasticity.⁹ In order to show the effect of neglecting the effect of autocorrelation on the standard errors, we also calculate prediction confidence bands using non-robust (OLS) standard errors.

Model uncertainty 2. The choice of common versus country-specific coefficients is a source of model uncertainty.

Model (4.2), our benchmark model, is a fixed effects panel model. The intercept a_{0i} is country specific; the latter represent the so-called 'fixed effects' allowing for time-invariant differences in interest rates between countries.

⁹ Using standard notation, the OLS variance estimator is $Var_{OLS} = \frac{1}{N-k} \sum_{i=1}^N e_i^2 \cdot (X'X)^{-1}$, whereas the robust cluster variance estimator is $Var_{cluster} = (X'X)^{-1} \cdot \sum_{j=1}^{n_c} u_j' u_j \cdot (X'X)^{-1}$, where $u_j = \sum_{i \in cluster} e_i x_i$ and n_c is the total number of clusters, e_i is the residual for the i th observation and x_i is a row vector of predictors including the constant. For simplicity, the multiplier (which is close to 1) has been omitted for the formula for $Var_{cluster}$. For more information on robust standard errors in panel regressions, see e.g. Hoechle (2007).

The coefficients of the explanatory variables are assumed to be equal across countries, as are their marginal effects. Our assumption behind this modelling framework is that investors assess country risks in a portfolio context and use similar norms towards the issuing countries, like rating agencies do (as discussed in Section 4.2.2). Because the pooling assumption is strong, we also test heterogeneity of some of the coefficients across regions or country groups (as in Beirne and Fratzscher, 2013), using a region or country group dummy D_g :

$$\begin{aligned}
 r_{it} = & \alpha_{0i} + \alpha_1 r_{fit} + \alpha_2 cpi_{it} + \alpha_3 cpi_{it} * D_g + \alpha_4 gdp_{it} + \\
 & \alpha_5 gdp_{it} * D_g + \alpha_6 debt_{it} + \alpha_7 debt_{it} * D_g + \alpha_8 (debt_{it} * fin_{it}) + \\
 & \alpha_9 (debt_{it} * fin_{it}) * D_g + \alpha_{10} car_{it} + \alpha_{11} car_{it} * D_g + \alpha_{12} fin_{it} + \\
 & \alpha_{13} fin_{it} * D_g + e_{i,t}
 \end{aligned} \tag{4.3}$$

We also estimate models separately for each country, thus allowing all coefficients to differ between all countries (as in, for instance, D'Agostino and Ehrmann, 2013):

$$\begin{aligned}
 r_{it} = & \alpha_{0i} + \alpha_{1i} r_{fit} + \alpha_{2i} cpi_{it} + \alpha_{3i} gdp_{it} + \alpha_{4i} debt_{it} + \\
 & \alpha_{5i} (debt_{it} * fin_{it}) + \alpha_{6i} car_{it} + \alpha_{7i} fin_{it} + e_{i,t}
 \end{aligned} \tag{4.4}$$

The main advantage of panel data models is that both time and cross-sectional information in the data are exploited. Another important advantage of panel data models as opposed to country-specific models, which is specifically relevant for the research question at hand, is that the residuals do not have to add up to zero for each country. In other words, while country-specific models force overpricing and underpricing for a country to cancel out, panel data models allow countries to exhibit more overpricing

than underpricing or vice versa during the sample period.

Model uncertainty 3. The sample selection is a source of model uncertainty.

As the selection of countries is important, we select a representative group of 17 advanced economies. Not only 11 euro area countries, but also 6 non-euro area countries are selected. The latter group consists of both EU and non-EU countries. More information follows in the Data Section. For our sample period (January 2001–December 2013) we have data with a relatively high (monthly) frequency which allows us to capture the developments in financial markets. To show the effects of sample selection on the findings, we estimate our models for the whole sample and for sub-samples.

Model uncertainty 4. The choice of including or excluding financial market variables is a source of model uncertainty.

In our benchmark model, financial market conditions (*fin*) are included. The reason is that our theoretical model assumes that the risk premium also contains a premium for market volatility and liquidity. One could question whether this is justified. Often, in times of stress on financial markets, liquidity is extremely low and volatility high, so that implicitly part of the mispricing is added as an explanatory variable. Therefore, we also estimate the fixed effects panel model excluding *fin* and *debt* $\times$ *fin* among the explanatory variables (as in De Grauwe and Ji, 2013a; Poghosyan, 2012):

$$r_{it} = \alpha_{0i} + \alpha_1 r_{fit} + \alpha_2 cpi_{it} + \alpha_3 gdp_{it} + \alpha_4 debt_{it} + \alpha_5 car_{it} + e_{i,t} \quad (4.5)$$

Model uncertainty 5. The choice of fixed versus time-varying coefficients is a source of model uncertainty.

In benchmark model (4.2), the coefficients are fixed throughout the whole sample period, as in Poghosyan (2012) and Steinkamp and Westermann (2012). However, it is conceivable that the relationship is not constant

through time. Hence, following, for instance, Bernoth et al. (2012), Giordano et al. (2013) and Beirne and Fratzscher (2013), we also estimate the model interacting with a dummy variable D_c distinguishing the crisis period from the pre-crisis period, which is set to start from January 2010 onwards.

$$\begin{aligned}
 r_{it} = & \alpha_{0i} + \alpha_1 r_{it} + \alpha_2 cpi_{it} + \alpha_3 cpi_{it} * D_c + \alpha_4 gdp_{it} + \\
 & \alpha_5 gdp_{it} * D_c + \alpha_6 debt_{it} + \alpha_7 debt_{it} * D_c + \alpha_8 (debt_{it} * fin_{it}) + \\
 & \alpha_9 (debt_{it} * fin_{it}) * D_c + \alpha_{10} car_{it} + \alpha_{11} car_{it} * D_c + \alpha_{12} fin_{it} + \\
 & \alpha_{13} fin_{it} * D_c + e_{i,t}
 \end{aligned} \tag{4.6}$$

In the empirical section, we will illustrate how these sources of model uncertainty affect the extent of over and underpricing. But first, we discuss the data.

4.4 Data

Our dataset contains 17 advanced economies, of which 11 euro countries and 6 non-euro countries (for comparison purposes).¹⁰ The data frequency is monthly and the sample period is January 2001 to December 2013. The panel data set is highly balanced. Hence, we extend the sample of D'Agostino and Ehrmann (2013), who also use Consensus forecasts, from their G7 countries to our 17 countries. We add 6 non-euro countries where the bulk of the literature only includes euro countries.¹¹ Focusing on advanced economies only seems appropriate as the sovereign debt crisis hit the euro area and the western world.

¹⁰ The 11 euro countries are Austria, Belgium, Germany, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal and Spain. The 6 non-euro countries are Canada, Japan, Sweden, Switzerland, the United Kingdom and the United States.

¹¹ To compare, De Grauwe en Yi (2012) have EMU-countries plus 8 other advanced economies. True, Poghosyan (2012) has 22 advanced economies; however, he uses annual instead of monthly data and realisations instead of expectations. Other studies including more countries typically include emerging economies.

The dependent variable is the 10 year sovereign bond yield (r). For the risk-free rate (rf) we use the swap rate (euro overnight index for euro area countries; US and UK swap rates for the US and the UK, respectively).

For the macroeconomic variables we use Consensus forecasts, which are available for each month m of a particular year for the current year y and the next year $y + 1$. Following Dovern et al. (2012) and D'Agostino and Ehrmann (2013), we derive average forecasts for the coming 12 months. This acknowledges that interest rates reflect market expectations about future developments. If F_m^y is the Consensus forecast in month m for the current year y , and F_m^{y+1} is the Consensus forecast for $y + 1$, then the weighted average for the next 12 months is defined as: $(F_m^y * (12 - m) + F_m^{y+1}) / (12)$, with $m = 1, \dots, 12$.

The market conditions variable is the principal factor of two financial variables: volatility and liquidity. Liquidity is measured as the monthly average of daily bid-ask spreads, volatility is the monthly average of the daily differences between the highest and lowest bond price. We take the principal factor of these two highly correlated variables (within correlation is 0.80) to reduce the number of explanatory variables in our regression models and to have one composite indicator of financial market conditions reflecting both liquidity and volatility.

Appendix A gives the definitions and sources of all variables. Table 4.1 presents summary statistics. Table 4.2 reports the correlation matrix for the panel-demeaned variables, i.e. the variables minus the means by country. The reason for showing correlations for panel-demeaned variables is that the panel models assume fixed country effects, so that the relevant variables to look at are the variables after removing the panel means. Most right-hand side variables are not strongly correlated (correlations are below 0.45), with a few exceptions. We will test whether multicollinearity is a problem for our benchmark regression model.

The outcomes of a unit root test suggested by Levin et al. (2002) show that, when suppressing panel-specific means, the presence of a unit root in

all panels can be rejected for all variables except *car* and *debt* (Appendix B).

Table 4.1. Summary statistics

	mean	median	st.dev.	min	max	obs.
<i>r</i>	4.001	−3.1	−2.7	−1.5	−0.7	2652
<i>rf</i>	2.347	2.425	1.561	0.076	6.283	2652
<i>cpi</i>	1.823	1.900	0.900	−1.300	4.400	2652
<i>gdp</i>	1.599	1.800	1.544	−5.300	7.500	2652
<i>debt</i>	82.888	73.129	40.078	26.024	249.741	2652
<i>fin</i>	2.070	−0.226	20.841	−0.671	227.850	2652
<i>car</i>	0.554	0.095	5.071	−14.203	15.522	2652

Explanatory note: *r* = yield on 10 year government bond, *rf* = risk free rate, *cpi* = expected inflation rate, *gdp* = expected real gdp growth, *debt* = expected debt ratio, *fin* = financial market conditions, *car* = expected current account ratio. Variable definitions are given in Appendix A.

Table 4.2. Correlation coefficients, panel demeaned variables

	<i>r</i>	<i>rf</i>	<i>cpi</i>	<i>gdp</i>	<i>debt</i>	<i>fin</i>
<i>rf</i>	0.106					
<i>cpi</i>	0.167	0.354				
<i>gdp</i>	−0.344	0.548	0.565			
<i>debt</i>	0.286	−0.632	−0.351	−0.546		
<i>fin</i>	0.525	−0.159	−0.209	−0.361	0.362	
<i>car</i>	0.025	−0.061	−0.097	0.055	0.209	0.120

Explanatory note: For variable names, see Table 1. Variable definitions are given in Appendix A.

4.5 Results for the benchmark model

The results of the benchmark model (4.2) are presented in the first column of Table 4.3. The (robust) standard errors indicate that *rf*, *gdp* and *debt* are statistically significant and their coefficients have the expected signs. The other variables, *cpi*, *fin* $\times$ *debt*, *fin* and *car* are not significant.¹² Our measure *fin* is not used in the rest of the literature, which makes it difficult to compare results. The insignificance of *car* is also found by De Grauwe and Ji (2013a) and Beirne and Fratzscher (2013), while D’Agostino and Ehrmann (2013) do

¹²Multicollinearity does not seem to be a problem; the highest value for the Variance Inflation Factor is 5.1.

find significant results. Our variable *cpi* is not used in many studies, but Poghosyan (2012) finds a significant effect.

Using these estimates, Figure 4.8 in Appendix C plots the actual versus the predicted yields for all 17 countries, including the 95 per cent confidence intervals for the predictions which are based on the robust standard errors.¹³ For the sake of clarity, Figure 4.3 shows the same actual-prediction plots for a selection of five periphery countries.

Figure 4.3 suggests that there has not been consistent and massive mispricing of yields throughout the whole of the periphery of the Eurozone. Instead, there has been some mispricing during certain periods since the sovereign crisis started in 2010. The greatest mispricing seems to have occurred for Greece and Ireland during the second half of 2011. To a lesser degree some mispricing is also discernible in this period for Portugal, while Spain has displayed some misalignment in the summer of 2012 and Italy in the fall of 2011.¹⁴ According to the model, some mispricing was also present in Belgium, France, the UK, the US and Canada (Figure 4.8 in Appendix C). Our model also suggests underpricing in some cases. Between 2005 and 2008 there was underpricing in Greece and Portugal (Figure 4.3), which suggests that investors were too optimistic on the fundamentals of these countries. At the end of the sample period (2012-2013), after the introduction of the OMT, some underpricing is discernible for Greece and Ireland. In the UK, the US and Canada, also some underpricing was present in the last two years of the sample. This could reflect the effect of unconventional monetary policy on long-term interest rates.

¹³ The standard errors on which the confidence bands are based are robust for the presence of autocorrelation and heteroskedasticity. The Wooldridge test rejects the null hypothesis of no first-order autocorrelation in the panel data (F-value = 449.8, p-value = 1%). The modified Wald test also rejects the null of no country-wise heteroskedasticity in the fixed effects regression (Chi-squared = 32,398; p = 1%).

¹⁴ The width of the confidence bands changes over time due to the adjustment of the robust standard errors for heteroskedasticity. The width of the confidence bands may also differ between countries due to different degrees of intra-country correlation of the residuals for which the robust standard errors have been adjusted.

Table 4.3. Estimation results. Dependent variable is yield on 10 year government bond

	Model (4.2) benchmark model (1)	Model (4.3) for euro countries interacted with periphery dummy (2)	Model (4.5) excluding financial conditions (3)	Model (4.6) interacted with crisis dummy (4)
Risk free rate	0.717 *** (0.129)	0.622 ** (0.099)	0.831 *** (0.187)	0.595 *** (0.130)
Inflation expectations	0.214 (0.293)		0.081 (0.223)	
x Dummy = 0		0.371 ** (0.132)		−0.115 (0.150)
x Dummy = 1		1.297 ** (0.566)		−0.069 (0.247)
Growth expectations	−0.513 ** (0.261)		−0.653 ** (0.308)	
x Dummy = 0		−0.059 (0.064)		−0.153 (0.093)
x Dummy = 1		−0.675 ** (0.260)		−1.210 *** (0.390)
Debt forecast	0.036 ** (0.014)		0.049 ** (0.020)	
x Dummy = 0		−0.003 (0.011)		0.018* (0.009)
x Dummy = 1		0.078 *** (0.022)		0.002 ** (0.007)
Financial conditions x debt forecast	−0.00006 (0.0007)			
x Dummy = 0		0.010 *** (0.002)		0.002 (0.006)
x Dummy = 1		−0.0005 (0.0003)		0.0001 (0.0005)
Current account forecast	−0.025 (0.050)		0.006 (0.043)	
x Dummy = 0		−0.035 (0.0003)		−0.671 (0.0005)
x Dummy = 1		−0.161 *** (0.031)		−0.035 (0.053)
Financial conditions	0.051 (0.130)			
x Dummy = 0		−0.105 (0.149)		0.063 (0.283)
x Dummy = 1		0.043 (0.060)		0.003 (0.094)
R ² - within	0.469	0.600	0.351	0.567
Number of observations	2633	1708	2633	2633
Number of countries	17	11	17	17

Explanatory note. Fixed country effects included (not reported). Robust standard errors within parentheses. ***, **, * denote p-values less than or equal to 1%, 5%, 10%, respectively. For model (3) and (6), coefficients are reported for subsamples for which the interacted dummy variable is equal to 0 and 1, respectively. Variable definitions are given in Appendix A.

Figure 4.3. Benchmark model (4.2), robust standard errors

The underpricing at the end of the sample (2012-2013) suggests that Greece and Ireland would have experienced higher yields if OMT had not been announced. This has also been argued by some policy makers (e.g., Draghi, 2013a; Coeuré, 2013). However, it is hard to fully attribute the underpricing to OMT. First, OMT has not been used since its announcement. Second, there are many more unobservable factors besides OMT affecting yields. In fact, the decline in yields since 2012 may not only be due to the OMT, but also due to the implicit decision to keep Greece in the eurozone, the establishment of the banking union and the announcement of important structural reforms in vulnerable countries. All these factors do not influence the fundamentals directly, but could have significant effects on market confidence. In our modelling approach, all such factors are captured in the residual. It would be an interesting topic for further research to try to disentangle these unobservable factors more precisely.¹⁵

Focusing on overpricing, the column 0 of Table 4.4 reports the extent to which sovereign yields are higher than the fundamental value according to our benchmark model, defined as the actual yield minus the upper boundary of the 95% confidence interval for the model prediction, if positive (negative differences are set to zero). Panel A reports the mean values of the overpricing during the crisis period, in percentage points, Panel B reports the maximum values during the crisis period, and Panel C gives the number of months of overpricing during the crisis period. The sovereign debt crisis started at the end of 2009, when it became clear that fiscal policy in Greece was not sustainable. Therefore, the crisis period is set to January 2010 until the end of the sample period.

Mean overpricing was most substantial in Greece (7.7 percentage points), followed by much more modest mean overpricing in Ireland (1.5

¹⁵ Examples of studies trying to capture the effects on yields of other unobservable factors than OMT, are Mody (2014) on the effects of the German-French bail-in agreement of Deauville, Gade et al. (2013) looking at the effect on spreads of communication about the sovereign crisis (such as Greece-bashing), and Beetsma et al. (2014) on the effect of the SMP on the covariance of bond spreads.

Table 4.4. Overpricing during crisis period, percentage points

	Benchmark Model (4.2): robust standard errors	Model (4.2) with OLS standard errors	Model (4.3): country specific	Subsample: Model (4.3) for euro countries with periphery dummy	Model (4.5): excluding financial conditions variable	Model (4.6) Crisis dummy
Model uncertainty	(0)	(1)	(2)	(3)	(4)	(5)
<i>Panel A. Mean values</i>						
Austria	0.0	0.3	0.3	0.0	0.0	0.1
Belgium	0.4	0.6	0.3	0.0	0.6	0.6
Canada	0.2	0.3	0.4	.	0.2	0.4
Finland	0.0	0.2	0.3	0.0	0.0	0.2
France	0.0	0.1	0.2	0.0	0.0	0.0
Germany	0.0	0.3	0.1	0.0	0.0	0.1
Greece	7.7	6.9	7.6	7.3	7.7	7.2
Ireland	1.5	1.6	0.7	1.5	1.2	1.8
Italy	0.4	0.5	0.3	0.0	0.4	0.0
Japan	0.0	0.4	0.0	.	0.0	0.0
Netherlands	0.0	0.3	0.2	0.0	0.0	0.0
Portugal	1.2	1.9	0.6	0.0	0.6	0.2
Spain	0.5	0.8	0.3	0.3	0.4	0.3
Sweden	0.0	0.3	0.2	.	0.0	0.1
Switzerland	0.0	0.4	0.1	.	0.0	0.0
United Kingdom	0.0	0.2	0.3	.	0.0	0.1
United States	0.0	0.3	0.2	.	0.0	0.4
Model uncertainty	(0)	(1)	(2)	(3)	(4)	(5)
<i>Panel B. Maximum values</i>						
Austria	0.0	0.5	0.6	0.0	0.0	0.4
Belgium	1.1	1.3	0.6	0.0	1.5	1.3
Canada	0.4	0.8	0.8	.	0.5	0.9
Finland	0.0	0.4	0.6	0.0	0.0	0.3
France	0.0	0.1	0.4	0.0	0.0	0.0
Germany	0.0	0.6	0.3	0.0	0.0	0.1
Greece	20.3	24.4	17.1	7.3	20.7	18.8
Ireland	3.5	4.8	1.9	1.5	4.1	4.1
Italy	0.8	2.3	1.0	0.0	0.4	0.0
Japan	0.0	0.5	0.1	.	0.0	0.0
Netherlands	0.0	0.6	0.6	0.0	0.0	0.0
Portugal	3.9	5.4	1.2	0.0	2.2	0.4
Spain	1.4	1.6	1.0	0.3	1.2	0.3
Sweden	0.0	0.9	0.6	.	0.0	0.1
Switzerland	0.0	0.7	0.3	.	0.0	0.0
United Kingdom	0.0	0.4	0.6	.	0.0	0.2
United States	0.1	0.5	0.6	.	0.0	0.7
Model uncertainty	(0)	(1)	(2)	(3)	(4)	(5)
<i>Panel C. Number of months</i>						
Austria	0	17	18	0	0	11
Belgium	22	27	14	0	24	18
Canada	9	16	12	.	11	15
Finland	0	13	18	0	0	6
France	0	4	16	0	0	0
Germany	0	14	17	0	0	4
Greece	17	28	8	9	16	15
Ireland	17	25	19	15	14	19
Italy	2	40	15	0	1	0
Japan	0	9	16	.	0	0
Netherlands	0	11	19	0	0	0
Portugal	20	37	19	1	10	2
Spain	16	23	21	1	11	3
Sweden	0	20	17	.	0	1
Switzerland	0	27	13	.	0	0
United Kingdom	0	6	15	.	0	8
United States	16	7	14	.	0	11

Explanatory note: Overpricing = Actual yield minus upper confidence bound for prediction, if positive. Negative differences have been set to zero. The crisis period is from January 2010 onwards.

and Portugal (1.2), and very little overpricing in Spain (0.5) and Italy (0.4; see Table 4.4, Panel A, column 0). Greece also had the highest maximum overpricing (20.3), compared to much smaller values in Ireland (3.5) and Portugal (3.9) and especially in Spain (1.4) and Italy (0.8; see Panel B). The number of months of overpricing was 17 for Greece and Ireland, compared to Belgium (22), Portugal (20), Spain (16) and Italy (2; see Panel C).

Table 4.3 does not report estimates for the fixed effects a_{0i} in Model (4.2). As explained in Section 3, fixed effects represent time-invariant country effects which are related to some unobserved structural country-specific characteristic(s). We report the estimates for the fixed effects in Figure 4.4, together with their 95% confidence bands.¹⁶ The 17th country dummy, which due to the alphabetic order turns out to be for the United States, is omitted for collinearity reasons. The fixed effects have been centred, so that they can be interpreted as deviations from the mean.

Figure 4.4. Fixed effects, model (4.2)

Explanatory note: Bars represent the fixed effects, vertical lines the 95% confidence intervals. Fixed effects have been centred, so that they represent deviations from the sample mean.

¹⁶ The Wald test rejects the null that all fixed effects are jointly equal to zero (F-value = 8.03, p-value = 0.000).

Japan stands out with a strongly negative fixed effect of several percentage points. Technically, this compensates for the fact that Japan's debt ratio is the highest in the sample while Japan's sovereign yield is relatively low. Economically, this may reflect the relatively large domestic investor base for Japan's sovereign debt, which mostly results from the accumulation of pension savings coupled with a strong home bias (Andritzky, 2012). A similar story i.e. a relatively high debt ratio and a large domestically held share of government debt could explain the also quite sizeable negative fixed effect for Italy. By contrast, quite sizeable positive fixed effects are found for Ireland and Spain, but more surprisingly, also for Sweden and Finland. A possible explanation for Sweden and Finland may be that these countries had relative low debt ratios and relatively good growth prospects over the sample period, which may not be fully reflected in the level of long-term yields. A similar story may hold to some extent for Spain and Ireland. These countries grew fast and had very low debt ratios before the crisis (Gilbert et al., 2013). Since then, economic fundamentals of these countries deteriorated significantly.

4.6 Results for alternative specifications

In this section we present the results of some alternative modelling choices and sample selections, reflecting the five modelling uncertainties discussed in Sections 4.2 and 4.3.

4.6.1 The calculation of confidence bands for the model prediction (Model uncertainty 1)

We use standard errors which are robust to both autocorrelation and heteroskedasticity. If non-robust (OLS) standard errors would have been used for the calculation of the confidence bands, the latter would have been much narrower but misleading (as discussed in Section 4.3.2). Most of the recent empirical literature does not seem to use any confidence bands at all, with the exception of D'Agostino and Ehrmann (2013), who use "68% posterior

error bands of the fitted spreads obtained from the bayesian time-varying parameter models". With narrower confidence bands, over and underpricing would have turned out to be much greater, sometimes by up to several percentage points. Hence, with non-robust standard errors, we would have found larger and more frequent mispricing than with robust standard errors.

This is indeed apparent from Figure 4.5 (or, for all countries, Appendix C, figure 4.9), where the confidence bands have been based on non-robust standard errors and are therefore much narrower compared to the ones in figure 4.3. Table 4.4 (comparing column 1 to 0) indeed gives somewhat higher mean overpricing for several countries (Panel A), but especially higher maximum overpricing for many countries (Panel B) and overpricing in more months (Panel C). However, as mentioned in Section 4.3.2, without adjusting standard errors for autocorrelation and heteroskedasticity, the confidence intervals of the predictions are unreliable and therefore the measurement of over and underpricing is misleading.

4.6.2 Coefficients varying across countries (Model uncertainty 2)

In benchmark model (4.2), coefficients are assumed to be equal across countries.¹⁷ Therefore, we show results of regressions performed *separately* for individual countries, i.e. model (4.4). For reasons of space, we do not report the regression output for the 17 countries (these are available on request); instead we show the prediction plots in figure 4.6 for our selection of five countries (for all countries, see Appendix C, figure 4.10). Comparing figure 4.6 with figure 4.3, the predictions of the individual country models follow the actual yields more closely than the panel models. Also, the confidence bands (which are both based on robust standard errors) for the country-specific models are narrower than for the panel model. This makes sense, as the model better takes into account differences between countries

¹⁷ Obviously, the Wald test rejects equality of all coefficients across all countries ($F = 76.7$, $p = 0.000$).

Figure 4.5. Benchmark model (4.2), non-robust standard errors

and therefore improves the overall fit. The country model is more flexible as cross-country variability of all coefficients is allowed.

According to the country-specific estimates, there is evidence of some misalignment for all countries. Generally, the amount of overpricing is smaller than in the benchmark model, which is in line with our expectations. However, there are exceptions for some countries for which the benchmark model found no overpricing (Table 4.4). This is because the model follows actual rates more closely on the one hand, but at the same time reduces the confidence bands on the other hand. In any case, it is clear that the use of country-specific coefficients does not remove mispricing altogether. This is in line with the findings of D'Agostino and Ehrmann (2013), who also find mispricing in country-specific estimations.

4.6.3 Using a sub-sample consisting of euro countries (Model uncertainty 3)

We select a sub-sample consisting of euro countries only. Hence, we drop the non-euro countries from our sample. We differentiate between the so-called periphery countries (Ireland, Italy, Portugal, Spain and Greece) and the non-periphery countries, via interaction with a periphery dummy; D_g in model (4.3) is the periphery dummy. The results (second column of Table 4.3) suggest that inflationary expectations have opposite effects on yields in both groups of euro countries: the expectation of one percentage point more inflation has an effect of 120 basis points in the periphery countries, while the effect is -37 basis points in the other euro countries. A possible explanation for the different sign of the inflation effects is that rising inflation in periphery countries is detrimental for their competitive position (which, in turn, is a main determinant of debt sustainability). In non-periphery countries the effect of inflation will to a large extent be reflected in the risk-free rate. A one percentage point higher growth prospect has a significantly negative effect (-68 basis points) on yields in the periphery countries, but is insignificant in the other countries. The debt ratio has a significant effect of

Figure 4.6. Country-specific estimation, model (4.4)

+0.08 on yields in the periphery, while no significant effect is found for the non-periphery euro countries. This confirms the results of Aizenman et al. (2013b), Poghosyan (2012) and De Grauwe and Ji, (2013a), who find that yields in the euro area's periphery are higher than in other countries with comparable macroeconomic fundamentals.

The extent of overpricing is lower according to this model in comparison to both previous models. Only Greece shows substantial mean overpricing (7.3 percentage points) during nine months and Ireland shows mean overpricing (1.5) during 15 months (Table 4.4, column 3, Panels A and C). Two factors explain this. The first factor is the exclusion of countries outside the euro area with their own currency. The second is the fact that we allow markets to react more strongly to fundamentals in periphery countries. It underlines how sensitive the extent of overpricing is to the selection of countries in the sample.

4.6.4 Financial market conditions (Model uncertainty 4)

To test for the effect of excluding the financial conditions variable on the estimates, we have estimated model (4.5). Poghosyan (2012) and De Grauwe and Ji (2013a) do not include such a variable. The results (third column of Table 4.3) for our sample of 17 countries show that R^2 falls to 0.35; hence, the exclusion of financial conditions clearly reduces the overall fit of the model. As a consequence, the predictions also follow the actual yields less closely than in the benchmark model including *fin* (Figure 4.7 for the periphery or Appendix C, figure 4.11 for all countries). However, the exclusion of the financial market variable does not completely change the picture for overpricing. The model finds a comparable extent of overpricing to our benchmark model for a number of countries, including Greece, Ireland, Spain and Italy (Figure 4.7 and Table 4.4, column 4). Both mean and maximum overpricing are substantial in Greece and to a lesser extent Ireland, while Italy and Spain display more limited overpricing. However, somewhat surprisingly, the extent of overpricing is reduced compared to our benchmark model substan-

tially in Portugal. Again, this is probably because the effect of a generally lower fit on the one hand is compensated by the effect of wider confidence bands on the other. In any case, an important question remains to what extent financial variables like liquidity should be considered as a fundamental.

Many studies use market variables which are uniform to all countries instead of country specific. For example, the VIX index and the TED spread are well-known indicators of market stress (e.g. in Hakkio and Keeton, 2009). We also replaced our financial conditions variable by the principle component of the VIX index and the TED spread, as these two series contain highly similar information. Basically, the results (not reported but available from the authors) confirm the results of the model excluding the financial conditions variable. This is to be expected, as the VIX-cum-Ted spread variable is not country-specific but uniform to all countries and therefore has a similar effect as a time dummy in the panel regression.

4.6.5 Time variability of the coefficients (Model uncertainty 5)

The benchmark model assumes that all coefficients are constant over time. To relax this assumption, we estimate model (4.6) interacting all variables with a sovereign crisis dummy variable which has value 1 from January 2010 onwards and 0 before. In this way, we can see whether and how the relationship has changed because of the European sovereign debt crisis. This approach has also been followed by Giordano et al. (2013) and Beirne and Fratzscher (2013).

From the estimation results (fourth column of Table 4.3) it can be seen that notably the importance of gdp has increased significantly during the crisis (at the 5% significance level). The prospect of one percentage point more growth has an effect of -121 basis points on bond yields during the crisis, compared to -15 before. This result confirms previous findings that markets pay closer attention to macroeconomic fundamentals during the crisis, which can be seen as a form of wake-up call contagion (Giordano et

Figure 4.7. Excluding the financial market variable, model (4.5), robust standard errors

al., 2013; Beirne and Fratzscher, 2013). Interestingly, our results suggest that during the crisis markets are particularly worried about the effect of lower economic growth on debt sustainability, which confirms results of Cottarelli and Jaramillo (2013).

According to this model variant the extent of overpricing is reduced in comparison to the benchmark model for Portugal. However, overpricing in Ireland is higher. In general, the model shows that overpricing is substantial in Greece and Ireland (Table 4.4, column 5).

4.6.6 Summary

Table 4.4 summarizes the extent of misalignment for all six models presented above. It is clear that the extent of overpricing depends on the modelling choice. The case of Greece is unambiguous: all models suggest mispricing, on average around 700 basis points. Also for Ireland, all models indicate overpricing, on average within a range of 70–180 basis points. For Portugal, five out of six models indicate mispricing, ranging from 20 to 190 basis points. For Belgium, it ranges from 30 to 60 basis points and for Spain from 30 to 80 basis points. For Italy, mean mispricing ranges from 30 to 50 basis points.

4.7 Conclusions

Our results do not point to consistent and massive mispricing of sovereign bond prices of countries in the periphery of the Eurozone. A significant part of the increase in yields can be explained by the deterioration of macroeconomic fundamentals like growth and government debt, while financial variables also played a role in some countries. However, our results do show that sovereign yields cannot be fully explained by macroeconomic fundamentals alone. This applies in particular to the countries in the periphery of the euro area. In all model specifications, we find periods of substantial misalignment of Greek bond yields. Most specifications also indicate some periods of mispricing for Portugal, Ireland, Spain and Belgium. For Italy, the

evidence of mispricing is less strong.

We also find that sovereign yields react more strongly to economic growth prospects during the sovereign crisis (starting January 2010) than before. Within the euro area group of countries, sovereign yields of the countries in the periphery are found to react more strongly to economic growth prospects as well.

At the same time, modelling uncertainty makes it impossible to determine precisely the extent of misalignment. We show that the extent of overpricing is affected by modelling choices, in particular with regard to i) the use and calculation of confidence bands for the model prediction, ii) the sample selection, iii) the assumption whether the model coefficients are similar across countries or not, iv) the inclusion of financial variables, and v) the usage of fixed or time-varying coefficients.

Unfortunately, it is difficult to determine the relative merit of the various specifications. It cannot be determined on the basis of econometric diagnostics alone, because a search for possible mispricing does not necessarily require the best econometric fit of the model. The choice for a specific specification therefore also requires economic judgment, and this will by definition always remain subject to debate. Econometric models cannot fully solve the fundamental uncertainty about the fairness of bond yields.

This has a number of consequences. First, our findings call for modesty in interpreting the outcomes of specific model specifications. Better awareness on how the specific modelling choices affect the extent of mispricing is needed, and a final verdict should preferably be made on the basis of a number of different specifications. Second, our results call for cautiousness in using estimates of bond yield models in policy making. As models cannot determine mispricing precisely, decisions about possible interventions should always be based on a broad set of information criteria, ranging from model output to expert judgment and market evidence. Finally, more research is necessary to determine the causes and nature of mispricing more

precisely, in particular with regards to perceptions of political developments and monetary policy decisions.

Appendix A. Data definitions and sources

Table 4.5. Data definitions and sources

Variable name	Description	Definition	Sources
<i>r</i>	Yield on 10 year government bonds	Monthly average	Datastream
<i>rf</i>	Euro overnight index swap rate	Monthly average	Datastream
<i>cpi</i>	Inflation rate, Consensus forecast	Monthly, weighted average for next 12 months (a)	Consensus Economics
<i>gdp</i>	Real GDP growth rate, Consensus forecast	Monthly, weighted average for next 12 months (a)	Consensus Economics
<i>debt</i>	Debt ratio, expected	Debt ratio minus <i>bal</i> ; debt ratio seasonally adjusted and interpolated from quarterly figures (b)	OECD, Consensus Economics
<i>bal</i>	Budget balance, % GDP, Consensus forecast	Monthly, weighted average for next 12 months (a)	Consensus Economics
<i>fin</i>	Financial market conditions. Principal component (c) of high-low and bid-ask spreads (d)	Monthly average	Own calculations based on Datastream
<i>car</i>	Current account ratio, Consensus forecast	Monthly, weighted average for next 12 months (a)	Consensus Economics

Explanatory note: (a) See data section (5.4) for the calculation of these averages. (b) If *bal* Consensus forecasts were not available, actual figures have been used. (c) The principle component is equal to $-0.733 + 6.930 \cdot \text{high-low spread} + 4.113 \cdot \text{bid-ask spread}$, and is therefore an indicator of illiquidity and volatility. (d) For Greece, bid-ask spreads are not available for most of the sample period. Therefore, *fin* for Greece has been based on the high-low spread; for this country, the high-low spread since April 2012 has been kept constant on the level of March 2012 as data were not available. For several countries, there were only a small number of missing values for high-low and bid-ask spreads that have been interpolated.

Appendix B. Levin, Lin and Chu (2002) unit root tests

Table 4.6. Levin, Lin and Chu (2002) unit root tests

variable	Panel means:		Time trends:		Included		Not included	
	Included		Not included		Included		Not included	
	Adjusted t	p-Value	Adjusted t	p-Value	Adjusted t	p-Value	Adjusted t	p-Value
<i>r</i>	-1.395	0.081	-1.723	0.042	-4.500	0.000		
<i>rf</i>	-0.804	0.210	-0.417	0.338	-6.573	0.000		
<i>cpi</i>	-2.020	0.021	-2.640	0.004	-3.959	0.000		
<i>gdp</i>	-2.521	0.005	-0.444	0.328	-6.328	0.000		
<i>debt</i>	0.302	0.619	-4.016	0.000	2.2222	0.986		
<i>fin</i>	-2.695	0.003	-3.946	0.000	-4.496	0.000		
<i>car</i>	1.669	0.952	4.921	1.000	-1.133	0.128		

Explanatory note: Ho: Panels contain unit roots, Ha: Panels are stationary. ADF regressions: 1 lag; Common AR parameter. LR variance: Bartlett kernel, 13 lags average (chosen by LLC).

Appendix C. Figures for all 17 countries

Figure 4.8. Benchmark model (4.2), robust standard errors

Figure 4.9. Benchmark model (4.2), non-robust standard errors

Figure 4.10. Country-specific estimation, model (4.4)

Figure 4.11. Excluding the financial market variable, model (4.5), robust standard errors

Chapter 5

Reforming the architecture of EMU: ensuring stability in Europe*

5.1 Introduction

During the 1990s, sceptics perceived plans for Economic and Monetary Union (EMU) as an ambitious project that would never fly, just like the emu, the large Australian bird.¹ Critics referred to the absence of political union (Feldstein, 1997b) and heterogeneity among EMU countries due to which the euro area was not considered an optimal currency area (Bayoumi and Eichengreen, 1993; De Grauwe, 2012b). It was argued that Europe fell far short of the United States, for example, in terms of labor mobility and fiscal integration (Gibson et al., 2014).

Still, as most European political leaders at the time were strongly committed to further European integration, EMU started in 1999. EMU was based on three mainstays. First, monetary policy was delegated to a strictly

* This chapter is based on De Haan, Hessel and Gilbert (2016). I thank Routledge for the permission to reprint. We thank Jan Marc Berk, Lex Hoogduin, Dirk Schoenmaker, Job Swank and Silvie Verkaart for useful comments and advice.

¹ Notably in the US, there was a lot of skepticism, summarized by Jonung and Drea (2009) as: "It cant happen, Its a bad idea, It wont last."

independent European Central Bank (ECB) with the primary objective of price stability. Second, fiscal policy remained a national responsibility, although fiscal policies had to comply with relatively strict rules. Third, except for trade and competition policies, macro-economic and financial policies (such as bank supervision) were left to the responsibility of Member States.

As pointed out by Buti and Carnot (2012: 900), the rationale for the constraints on national fiscal policy was that “unsustainable fiscal dynamics in one country may eventually entail costs borne by all EMU participants. This could happen either via inflationary debt monetization or through large fiscal transfers between countries”. By contrast, the potential spillover effects related to national economic policies were thought to be much smaller. This is why the Treaty contained no provisions in this area with the exception of the obligation for countries to “regard their economic policies as a matter of common concern and [...] coordinate them within the Council” (Article 121).

This original setup of the monetary union appeared to function successfully in its first ten years, at least on the surface. In 2008, only months before the collapse of Lehman Brothers that marked the start of the global financial crisis, then European Commissioner Almunia wrote: “A full decade after Europe’s leaders took the decision to launch the euro, we have good reason to be proud of our single currency. The Economic and Monetary Union and the euro are a major success.” (European Commission, 2008b, p. iii). However, in 2010 several important fault lines that had existed under the surface since the launch of the euro, notably weak public finances and persistent imbalances in some countries, unexpectedly became clearly visible in what is generally referred to as the euro crisis (Drudi et al., 2012).²

The euro crisis started in Greece. After several revisions of previously published deficit figures (even going back to the time of Greece’s admission in the euro area) had been published it became clear that public finances in Greece were unsustainable. On 10 May 2010, the ten-year yield spread

² There are numerous papers on the crisis. Excellent overviews are provided by Shambaugh (2012) and Lane (2012). See also the collection of papers in Gibson et al. (2014).

between Greek and German government bonds reached about 1,000 basis points. Similar concerns arose in Ireland, Portugal and, later, Spain and Italy. The interest spreads on government bonds of countries that came to be known as GIIPS did not only reflect increased credit risk, but also doubts about the sustainability of EMU.

A special feature of the crisis was what came to be known as the doom loop: the reinforcing relationship between the creditworthiness of sovereigns and banks. Concerns about the solvency of sovereigns fuelled concerns about the solvency of banks, given their large holdings of government bonds. In turn, this further fuelled concerns about the sovereigns' solvency, given the likelihood that they will have to bail out their relatively large banking systems.

Between 2010 and 2012, the ECB took several steps to combat the crisis. For instance, it continued the unlimited access to refinancing operations that started during the global financial crisis and decided to purchase public and private debt securities under the Securities Markets Programme (SMP), starting in May 2010. In December 2011, the ECB decided to conduct refinancing operations that significantly extended the horizon at which credit institutions could obtain liquidity from the Eurosystem. In particular, two three-year refinancing operations ("longer term refinancing operation", LTROs) have been conducted in December 2011 and February 2012 providing banks with potentially unlimited amounts of three-year loans. At the same time, the ECB announced more generous rules regarding the type of collateral it would require. The LTROs are widely considered as having achieved their aims: they ensured that no bank would face a liquidity squeeze for the next three years and this allowed the inter-bank market to start functioning again.

In these years, European political leaders took several steps to enhance the governance of EMU. For instance, the Stability and Growth Pact (SGP) has been revised as part of a set of reforms known as the "Six-Pack",

"Two-Pack" and the "Fiscal Compact", while the Macroeconomic Imbalance Procedure (MIP) has been introduced to prevent the emergence of macro-economic imbalances (see section 5.3 for details). Despite these steps, financial market volatility remained, not least because progress on several important political issues, notably support to Greece, was extremely slow, leading to doubts about the commitment of European leaders to the euro.³

It was only after ECB President Draghi told an investment conference in London in July 2012 that: "Within our mandate, the ECB is ready to do whatever it takes to preserve the euro. And believe me, it will be enough" that bond spreads of GIIPS countries started to decline substantially.⁴ To live up to those words, the ECB introduced the Outright Monetary Transactions (OMTs) programme in September 2012.⁵ With this instrument, the ECB made clear that scenarios involving the collapse of monetary union are out of the question. After European political leaders finally showed their commitment as well by agreeing on further support to Greece and the establishment of a banking union, financial markets calmed down.⁶ Interest rate spreads between the core countries and the periphery, which had to that point reflected increased risk of a euro break-up, narrowed sharply in the second half of 2012 (see Figure 5.1). Whether this development will continue, arguably will also depend on how credible the improvements in the architecture of EMU will turn out to be.

Even though the euro crisis as it unfolded was not fully foreseen even

³ According to Lane (2012: 60), "it may be fair to characterize Europe's efforts to address its sovereign debt problem as makeshift and chaotic, at least through the middle of 2012."

⁴ See <https://www.ecb.europa.eu/press/key/date/2012/html/sp120726.en.html>

⁵ The ECB announced its intention to intervene on a large scale in the event of disruptions in the bond markets of countries that duly implemented an adjustment programme. These interventions will not be aimed at a particular interest rate or spread level, but at countering expectations of a monetary union break-up that were reflected in interest rate movements. OMT interventions differ from the SMP: OMT interventions are in principle unlimited, do not enjoy privileged creditor status and are explicitly linked to sound policy. The conditionality attached to OMT interventions resolves coordination issues between the fiscal and monetary authorities. OMT interventions are sterilised.

⁶ See http://ec.europa.eu/economy_finance/assistance_eu_ms/greek_loan_facility/ for details.

by the critics of EMU, it made some serious shortcomings in the architecture clearly visible.⁷ Section 5.2 outlines what went wrong and why events unfolded so differently than expected. Section 5.3 discusses the improvements in the architecture of EMU. Even though substantial progress has been made, section 5.4 discusses how the current balance between policy coordination and risk sharing can eventually be improved.

Figure 5.1. 10-year government bond spread against German bonds

Source: ECB Statistical Data Warehouse (SDW) and authors' own calculations.

5.2 Shortcomings in the architecture of EMU

Especially during its first stages, the euro crisis was often primarily attributed to a lack of budgetary discipline. As hypothesized by Lane (2012), this probably reflects that the initial phase of the crisis was dominated by Greece, whose budgetary troubles could indeed be clearly attributed to a lack of budgetary discipline (and even deliberate statistical misreporting). Spain and Ireland, however, had stellar fiscal records when the crisis

⁷ Some of the shortcomings, such as fiscal rules and Europe-wide banking supervision, were discussed during the late 1980s and early 1990s, but Member States could not agree on solutions which implied further transfer of sovereignty. See James (2012) for a detailed discussion.

erupted before they too ran into budgetary problems. So a lack of budgetary discipline was not the only issue at play. Diverging financial cycles played a major role.⁸ In several Member States, macroeconomic and financial imbalances built up in the years prior to the crisis were a major factor behind the deterioration of public finances. When the euro crisis erupted, problems were amplified by the fact that the architecture of EMU did not contain provisions for the resolution of a major sovereign debt crisis.

Financial factors played an important role in the crisis. Before the eruption of the global financial crisis in 2008, financial factors were largely missing from macroeconomic paradigms, such as the theory of optimum currency areas, and they also hardly figured in the Maastricht treaty. Yet the start of EMU coincided with a period of very loose financial conditions. Many advanced economies experienced a strong growth of credit, house prices and the size of their financial sectors. Rapid financial integration induced a global surge in net and cross-border capital flows. The average size of foreign assets and liabilities in advanced economies increased from 70% of GDP in 1995 to over 210% of GDP in 2007. It even ran up to almost 300% of GDP in the euro area, as the euro further stimulated financial integration (Forbes, 2012). These financial factors amplified some of the vulnerabilities that already existed within EMU, and also created new ones that had not been anticipated (Lane, 2013; Obstfeld, 2013).

5.2.1 Non-compliance with the Stability and Growth Pact

Even though several academics had argued against the need to restrain national fiscal policies in a monetary union (cf. Buiter et al., 1993), the prevention of possible fiscal crises was a central preoccupation in the design of

⁸ The academic debate about EMU focused instead on diverging business cycles. Some authors argued that countries in the euro area would become more similar over time, as monetary union increases trade intensity and business cycle synchronization (Frankel and Rose, 1998). Initial studies on the trade effect indicated that currency unions lead to large increase in international trade (Rose, 2000). Since then, estimates of the trade effect of EMU have become much smaller (see, e.g., Berger and Nitsch, 2008), while Inklaar et al. (2008) find that the trade effect on business cycle synchronization is smaller than previously reported.

the single currency (Buti and Carnot, 2012). The Stability and Growth Pact (SGP), adopted in 1997, defined the restrictions on national fiscal policy as provided in the Maastricht Treaty in greater detail. Under its "preventive arm" countries were required to achieve and maintain fiscal positions that are close to balance or in surplus, thereby ensuring sustainability while allowing room for cyclical stabilization without breaching the deficit limit of 3% of GDP. Under its "corrective arm" procedural steps to be followed once deficits were considered excessive were delineated in the so-called Excessive Deficit Procedure (EDP), specifying conditions and deadlines and the ultimate possibility of financial sanctions as foreseen by the Treaty.⁹ The amendments of the SGP as introduced in 2005 brought more discretion and flexibility into the corrective arm, although the preventive arm became slightly more stringent (Amttenbrink and De Haan, 2006).

As we have shown elsewhere (de Haan et al., 2012; 2013), the major shortcoming of the SGP has been weak enforcement. There were no strong incentives for Member States to prevent other Member States from deviating from the objective to strive for a balanced budget in the medium term. Furthermore, Member States had no other means than peer pressure in the "preventive arm" of the SGP.

As a result, the preventive arm of the SGP was a dire failure. This is clearly illustrated in Figure 5.2, which is taken from Wierdsma (2006) and updated. Whereas EMU Member States submitted Stability Programs to the European Commission in which they outlined how they would reach a (cyclically adjusted) balanced budget, the budgetary adjustments that were implemented in practice were much less ambitious (Beetsma et al., 2009). Large countries, in particular, did not bring down their deficit sufficiently in economic good times (de Haan et al., 2004; Schuknecht et al., 2011). As a consequence, deficits exceeded the 3 per cent threshold once the economic downturn set in 2000/2001. It then became clear that the "corrective arm"

⁹For detailed discussions of the SGP, see Amttenbrink and de Haan (2003; 2006), Heipertz and Verdun (2010) and Schuknecht et al. (2011).

of the SGP was also weak. The European Council of Economics and Finance ministers (ECOFIN), was responsible for enforcing the rules. Based on a proposal of the European Commission, the ECOFIN had to decide whether an excessive deficit exists in a Member State, and if so which steps would then be taken. If a Member State did not take (sufficient) action to redress an excessive deficit, sanctions could be imposed. However, the ECOFIN would not automatically impose sanctions, as each step required a discretionary decision by the Council. And the same ministers who were responsible for drafting national budgets and who could therefore be accused of breaking the rules also had to decide whether one of their colleagues breached the same rules.

Figure 5.2. Weigthed average EMU-12 budget deficit, plan vs outcome

Note: expressed in %GDP. Source: European Commission and national stability programs of the respective countries. Figure based on update of Wierds (2006)

Financial markets did not discipline governments either, in contrast to the prediction of Buiter et al. (1993), as they hardly differentiated between sovereign bonds treating them all as (almost) risk-free (see Figure 5.1).¹⁰ General risk aversion was very low before the crisis and financial markets apparently did not consider the no-bail out clause as credible, expecting that

¹⁰De Grauwe and Ji (2012) argue that in the 2000 – 2008 period spreads were very close to zero even though underlying fundamentals differed widely. The dramatic increase in the spreads since 2008 were, according to De Grauwe and Ji (2012), significantly larger than the changes in the underlying fundamentals.

the Union would renege on the no-bailout clause, if needed, to avert a financial crisis. When market discipline eventually came by the end of the decade, it took the form of a "sudden stop" (Buti and Carnot, 2012).

As a result of this combination of factors, at the outset of the worldwide financial crisis in 2008 budget deficits and government debts were higher than they would have been if the rules of the SGP had been adhered to (see Table 5.1, which is based on numbers from the European Commission Spring Forecast 2008, and thus provides a real-time estimate of the budgetary situation).

Table 5.1. Budgetary starting situation in 2007

	GR	PT	FR	IT	EMU	D	NL	IE	ES
Budget balance	−6.4	−3.1	−2.7	−1.5	−0.7	0.3	0.2	0.1	1.9
Cyclically adjusted budget balance	−7.1	−2.6	−2.6	−1.3	−0.8	−0.1	0.1	0	2.1
Government debt	105	68.3	63.9	104	66.2	64.9	45.3	25	26.1

Note: figures are expressed in % GDP and come from the European Commission Spring Forecast 2008. For Greece numbers from after the revision of budgetary aggregates in 2009 are reported. See Gilbert and Hessel (2014).

5.2.2 The role of the financial cycle

Although the euro crisis has some characteristics of a sovereign debt crisis, it was not only caused by unsustainable fiscal policies. In fact, at the outset of the global financial crisis nobody expected that European public finances would become a problem. The European Commission (2008a: 37) even stated that structural deficits were at "the lowest level on record since the early 1970s".

This begs the question *why* the economic downturn following the financial crisis could cause such a large swing in the budgetary position of Member States. This seems related to the fact that the nature and size of divergences in EMU were different than expected. In line with the theory of optimum currency areas, divergence is frequently measured as business cy-

cle synchronization.¹¹ Yet, business cycles were very synchronized since the start of EMU, even during the crisis period (see Figure 5.3).

Figure 5.3. Business cycle fluctuations euro area highly synchronized

Source: Authors' calculations. Quarterly data for GDP filtered with HP-filter with $\lambda = 1600$.

Instead, the divergences in the euro area were much more related to the financial cycle than to the normal business cycle. Characteristics of the financial cycle are that i) it is driven by growth in credit and house prices, ii) it has a much longer duration than business cycles: 16-20 years instead of up to 8 years, and iii) it has a wider amplitude while the correction of the financial cycle is often accompanied by a financial crisis (Drehmann et al., 2012; Borio, 2012a,b). As the financial cycle was largely neglected before the financial crisis, this may explain why these large and long lasting divergences in the euro area were not sufficiently recognized. Just like financial imbalances like housing bubbles were not recognized in advanced countries outside EMU either.

The upturn of the financial cycle in the decade before the global financial crisis was a worldwide phenomenon. Many advanced economies witnessed very rapid credit and house price growth (Borio, 2012b). Yet within

¹¹ This is also reflected in the original setup of EMU. The balanced budget requirement in the Stability and Growth Pact would, for instance, enable countries to let automatic fiscal stabilizers work over the course of the (asymmetric) business cycle.

Figure 5.4. Financial cycle fluctuations euro area highly asymmetric

Source: Comunale and Hessel (2014). Measures in figure 5.4a inspired by Alessi and Detken (2009) and Drehmann, Borio, Gambacorta, Jimenez and Trucharte (2010). Calculated as quarterly GDP filtered with an HP-filter with $\lambda = 100.000$ (frequency of the financial cycle). Measures in figure 5.4b inspired by Borio, Disyatat and Juselius (2013, 2014). Calculated as principal component of the output gap (HP-filter $\lambda = 1600$), real credit growth and real house price growth.

the euro area, this financial cycle was asymmetric (see Figure 5.4, based on calculations in Comunale and Hessel, 2014). The upswing was strongest in a number of countries in the periphery, notably in Ireland, Spain and to a lesser extent Greece. In the run up to the financial crisis several countries had experienced strong credit booms, in part because joining the euro zone meant that their banks could raise funds from international sources in their own currency. Also, these countries were – at least initially – experiencing a process of real convergence, while lower interest rates related to EMU-membership fuelled consumption-related and property-related borrowing (Obstfeld, 2013). By contrast, the financial cycle was much more contained in Germany and Austria. This is partly because interest rates in these countries had already been low before EMU-membership. Germany was also recovering from a building boom induced by the reunification, while structural characteristics of the German housing market have likely also played a role. As a result, Germany is one of the very few advanced economies that managed to contain credit and house prices growth before the financial crisis (Hessel and Peeters, 2011).

The credit boom in some peripheral countries was fuelled by capital inflows. When cross-border financial flows dried up, countries with the greatest reliance on external funding were disproportionately affected. This applies especially to Ireland and Spain, where the resulting decline in construction was a major shock to domestic economic activity, while abandoned projects and falling property prices indicated large prospective losses for banks that had made too many property-backed loans (Lane, 2012).

5.2.3 Diverging competitiveness

The credit boom fuelled by capital inflows in much of Southern Europe facilitated another development that would come back to haunt EMU: diverging competitiveness positions. In the run up to the crisis, several countries saw their competitiveness deteriorate. Between 2001 and 2011 per unit labour costs in Greece rose by 33 per cent, 31 per cent in Italy, 27 per cent

in Spain and 20 per cent in Ireland. By contrast, they grew by only 0.9 per cent in Germany (Lin and Treichel, 2012), partly because the country needed to restore its price competitiveness after reunification. Although the large current-account deficits of some countries signaled competitiveness problems, the deficits were relatively easy to finance as financial integration increased the availability of foreign funding (Obstfeld, 2013; Reis, 2013). In fact, capital inflows continued pushing up money and credit growth, which, in turn, increased inflation and caused competitiveness to deteriorate further (Gibson et al., 2014).¹² Growing current account deficits in the periphery were accompanied by increasing surpluses in core countries like Germany and the Netherlands.

As countries in the euro area no longer have the possibility to devalue their currency or to use national monetary policy, external imbalances can only be restored by improving competitiveness.¹³ However, relative price adjustments without a change in the nominal exchange rate will be difficult when average euro area inflation is low; it will be a rather slow and painful route to rebalancing (Shambaugh, 2012), especially in the absence of further improvements in labour productivity.

The conventional wisdom before the crisis was that balance-of-payments of individual euro-area countries would become as irrelevant as among regions within a country (Blanchard and Giavazzi, 2002). Yet the euro crisis has challenged the wisdom of this view (Merler and Pisani-Ferry, 2012). Still, it took a while before this was realized. In fact, the financing of national external positions in a supranational monetary union could be interpreted as proof of successful integration of capital markets and of real convergence within a monetary union. However, if capital inflows fuel investments that

¹² Furthermore, Fernández-Villaverde et al. (2013) argue that capital inflows reduced the pressure for reforms by relaxing the budget constraints that the countries in question faced.

¹³ Although some authors argued that EMU increased the need for labour market flexibility and therefore the incentives to undertake labour market reform (Bean, 1998; Gibson et al., 2014), empirical evidence does not suggest that EMU led to significant labour market reforms (Bednarek et al., 2010).

have little effect on future productivity growth (such as real estate) and delay adjustment to structural shocks they pose risks (Giavazzi and Spaventa, 2011).

This is not to say that competitiveness was not on the agenda of the EU. In 2000, the EU declared that it wanted to “become the most competitive and dynamic knowledge-based economy in the world”. However, as argued by Wyplosz (2010), this so-called Lisbon strategy was a failure, as the mechanism of peer pressure on which it was based upon simply did not work (see also Kok, 2004). In addition, the recommendations were not always directly related to the emerging divergences described above (Fischer and Hobza, 2013). Therefore, the so-called Macroeconomic Imbalance Procedure (MIP) that was introduced aims to deal with monitoring competitiveness and where necessary redressing lack of competitiveness (see section 5.3.3).

When the financial crisis triggered a correction of these macro-financial imbalances, the budgetary impact was much larger than expected (Gilbert and Hessel, 2012, 2014). The average budget deficit in the euro area in 2009 was 5.2% of GDP larger than the European Commission had forecasted in March 2008, just months before the collapse of Lehman Brothers. The deterioration was even considerably larger in most of the countries in southern Europe, with the exception of Italy. In Portugal, Ireland, Greece and Spain, the budget deficit for 2009 increased by a staggering 11.2% of GDP on average.¹⁴ Contrary to popular belief, these budgetary reversals can be mainly attributed to a large decline in public revenue, while the direct costs of financial sector bailouts played a more limited role in most countries.¹⁵

The worsening fiscal positions were caused by the turn of the financial

¹⁴ The situation in Greece differs in one important aspect from the situation in the other countries, as the deterioration of the (actual) deficit is partly driven by an upward revision of the deficit figures for previous years.

¹⁵ See Gilbert and Hessel (2014), who find that only in Ireland the direct costs associated with financial sector bailouts played a serious role in the deterioration of public finances. These results are in line with the findings of Reinhart and Rogoff (2009) that financial crises usually lead to a large increase in government debt, caused primarily not by financial sector bailouts but by the deep and prolonged economic downturn.

cycle. Recent research shows that a turn of the financial cycle has a much larger negative impact on public finances than a turn of the normal business cycle (Borio, 2012b, Bénétrix and Lane, 2013). This is mostly due to their effect on government revenues (Eschenbach and Schuknecht, 2004; Dobrescu and Salman, 2011; Lendvai et al., 2011). Rising asset prices increase revenues in capital gains and transaction taxes. In addition, high wage growth increases income tax revenue, especially when the system is progressive. Finally, wealth effects stimulate domestic demand and thereby the revenues from indirect taxes. All these factors reverse when the financial cycle turns, resulting in a large budgetary deterioration. This points to an important omission in the SGP, as the macroeconomic, financial, and fiscal risks associated with the expansion in external imbalances, credit growth, sectoral debt levels, and housing prices were not taken into account in assessing Member States' fiscal policies (Lane, 2012; Buti and Carnot, 2012).

5.2.4 No crisis instruments

When the upward revision of the Greek deficit drew attention to the fragility of public finances in Europe, market discipline returned with a vengeance. It had an on/off-nature: while spreads hardly reacted before the crisis, they reacted very strongly afterwards (Knot and Verkaart, 2013). Strikingly, bond spreads in the euro area reacted much stronger to the fiscal deterioration than in other advanced economies (De Grauwe and Yi, 2012, Dell'Erba et al., 2013). This was partly a rational reaction to specific vulnerabilities in the euro area, such as the lack of the nominal exchange rate to facilitate adjustment (Gilbert et al., 2013). But it is also related to the exceptionally high level of financial integration. While financial integration is often seen as a way to stabilize asymmetric shocks (Asdrubali et al., 1996), it also exposes countries to pro-cyclical capital flows (European Commission, 2008a). Highly integrated EMU countries are therefore more vulnerable to contagion than other advanced economies (Forbes, 2012), also because the euro

may have increased the elasticity of capital flows (Lane, 2013).¹⁶ Indeed, the share of foreign-owned government debt has a large upward effect on bond yields in EMU countries (Dell’Erba et al., 2013).

In such an environment, it was unfortunate that the architecture of EMU did not contain provisions for the resolution of a major sovereign debt crisis. No doubt, this contributed to the “makeshift and chaotic” character of the decision-making process to deal with the crisis (Buti and Carnot, 2012). Initially, the Member States had created the (temporary) European Financial Stability Facility (EFSF) to provide financial assistance to euro area Member States (Greece, Ireland, and Portugal¹⁷) within the framework of a macro-economic adjustment programme. In October 2010, it was decided to create a permanent rescue mechanism, the European Stability Mechanism (ESM), which entered into force on 8 October 2012. In order to decouple weak banks from their national governments, it was agreed that, where necessary, banks could be recapitalised directly through this mechanism. The ESM is now the sole and permanent mechanism for responding to new requests for financial assistance by euro area Member States. It has a lending capacity of 500 billion euro.

Several authors have argued that lack of crisis instruments is problematic in view of the inherent instability in case of highly indebted sovereigns due to the lack of a lender of last resort for sovereign debt. As pointed out in section 5.1, the ECB is explicitly prohibited to purchase sovereign bonds in the primary market. According to Drudi et al. (2012: 893) this “prevents the ECB and Eurosystem central banks from becoming a kind of lender of last resort for governments and, more broadly, for any public sector bodies. It is precisely these limits which protect the integrity of the Eurosystem’s balance sheet and thus preserve the independence and credibility of monetary policy in the eurozone.” However, as pointed out by several authors

¹⁶ According to Forbes (2012), another reason for the larger susceptibility to contagion is that euro area countries share the common institutional framework of the monetary union. It is therefore much more likely that decisions concerning one country will also affect the others.

¹⁷ See <http://www.efsf.europa.eu/about/operations/index.htm> for details.

(De Grauwe, 2011; Gros, 2012; Buiter and Rahbari, 2012), financing a high national public debt may become problematic in a supranational monetary union.¹⁸ Here essentially the same mechanism is at work as in a bank run. If all depositors withdraw their money at the same time, the bank will not be able to liquidate immediately its loan portfolio. This is the main reason why central banks act as Lender of Last Resort (LoLR) for banks. Likewise, a solvent sovereign could be tripped into a fundamentally unwarranted payments default if the market were to adopt the "self-fulfilling fear equilibrium belief" that the government is not solvent (Buiter and Rahbari, 2012). As long as market confidence is high the government can pay interest payments, because its borrowing cost will be low. However, if market confidence is low the government may face a problem because the high-risk premium requested will make the debt service so expensive that it will not be able to find the necessary resources. Doubts about the ability of a government to service its debt could thus become self-fulfilling (Gros, 2012).

The implication of this analysis is that without a proper lender of last resort, bond yields in the euro area may display a higher risk of overshooting than yields in countries with their own currency. Yet, there is no consensus on the size and nature of this overshooting in the fast-growing literature on this topic.¹⁹ According to De Haan et al. (2014), this in part reflects modelling uncertainty. While these authors do not find support for consistent and massive mispricing for the all countries in the periphery of the euro area, they do identify periods with misalignments for Greece, Portugal and Ireland.

¹⁸ It is important to point out that this problem may occur even if the government has a balanced budget. If the government is highly indebted, every year a part of the debt matures and requires refinancing.

¹⁹ See de Haan et al. (2014) for an overview of this literature.

5.2.5 The doom loop

The funding problems of sovereigns were reinforced by a negative feedback loop with the banking sector. The banking system in the euro area is large.²⁰ Total assets of the banking system were equivalent to over 300 per cent of euro-area GDP in 2007, compared with less than 100 per cent in the United States (Shambaugh, 2012). The largest banks in the euro-area are large in proportion to their home economies. Furthermore, most banks heavily invested in government bonds with a home bias which is particularly strong for banks of troubled sovereigns (Greece, Ireland, Italy, Portugal, and Spain).²¹ In Spain, Portugal and Italy domestic banks owned around 25% of the outstanding stock of government debt (Pisani-Ferry, 2012). This is the basis for what came to be known as the “doom loop”. Drawing on Acharya et al. (2012), the essence of the problem can be described as follows.²² During the financial crisis, governments in several euro area countries engaged in large-scale, sometimes blanket, financial sector bailouts. Such bailouts require immediate issuance of additional debt by the sovereign causing an increase in the sovereign’s credit risk. This has two possible consequences.

First, the government runs the risk that this debt-overhang will affect the private sector. Households and corporations may anticipate that the high level of government debt will require higher taxes in the future, thereby diluting long-run returns on real-sector and human-capital investments. The resulting under-investment in the economy can cause economic growth to slow down, thereby further increasing the sovereign’s credit

²⁰ Banks in the euro area heavily depend on the interbank money market for their funding and notably the non-domestic component of the interbank market has been particularly volatile during the crisis (Reichlin, 2014).

²¹ One of the main reasons for this is that the Capital Requirements Directive (CRD), allows for a 0% risk weight to be assigned to government bonds issued in domestic currency. Moreover, the CRD exempts government debt issued in domestic currency from the 25% limit on large exposures that applies to all other asset holdings (Popov and van Horen, 2015). This was exacerbated by the fact that these bonds could be used as collateral in ECB operations (Reichlin, 2014).

²² See Acharya et al. (2014) and Farhi and Tirole (2018) for formal analyses. See also Obstfeld (2013).

risk. Second, the deterioration in the sovereigns creditworthiness may feed back adversely onto its financial sector through four channels (Mink and de Haan, 2013).²³ In the first place, the market value of the government debt on the balance sheet of the financial institutions reduces causing the financial sector's creditworthiness to decline. In the second place, higher sovereign risk reduces the value of collateral that financial institutions can use for funding purposes. In the third place, if sovereigns are downgraded by credit rating agencies this normally translates into lower ratings for banks located in the downgraded country. Finally, as the sovereign's creditworthiness declines, the value of the explicit and implicit government guarantees to the financial sector also declines, and this adversely impacts the financial sector's credit quality (Acharya et al., 2014; Obstfeld, 2013).

One of the consequences of financial institutions' exposure to impaired sovereign debt is that they may reduce their lending (Shambaugh, 2012). Popov and van Horen (2015) provide evidence for this. Lower credit growth may further reduce economic growth, thereby reinforcing the doom loop.

During the course of the euro crisis the exposure of foreign banks on sovereign debt of the GIIPS reduced, whereas the exposure of domestic banks increased. Whereas, for instance, in December 2010 domestic banks held 67% of Greek sovereign debt, in June 2013 this percentage had risen to 99 (EBA, 2013).²⁴ This made the problem of the doom loop even more pressing. A proper banking union would break this deadly embrace between sovereigns and financial institutions (see section 5.3.4).

Due to the doom loop, funding problems on sovereign bond markets in the periphery went hand in hand with funding problems for banks in these countries. As a result, many countries in the periphery at some point experienced an outflow of capital which constituted a sudden stop in external fi-

²³ Mody and Sandri (2012) present evidence on the joint dynamics of sovereign spreads and measures of banks' financial health.

²⁴ For the other GIIPS countries these percentages were as follows: Ireland from 66 to 84%, Italy from 66 to 84%, Portugal from 54 to 71% and for Spain from 78 to 89%. Source: EBA (2013).

nancing (Merler and Pisani-Ferry, 2012). Most of the capital fled to so-called core countries that were considered a safe haven (see Figure 5.5). It made banks in vulnerable countries very dependent on ECB funding, which was also reflected in growing imbalances in the Target2 settlement system. Target2 liabilities (and assets) reached around 1000 billion euro in the summer of 2012 (DNB, 2013). This financial fragmentation was at least partly driven by “unfounded fears on the reversibility of the euro” (Draghi, 2012).

Figure 5.5. Net capital flows within the euro area

Note: figures expressed in %GDP. Source: IMF and DNB.

5.3 The move towards a “genuine” monetary union

Over the last couple of years, important steps have been taken to repair the design flaws in EMU, under the guidance of blueprints by Van Rompuy (2012) and the European Commission (2012a). Significant progress has been made in a relatively short time period. Fear that the euro crisis would spread further, thereby undermining the stability of the euro area and perhaps even the sustainability of the currency union, created the political willingness to take these steps.

5.3.1 Improved fiscal discipline²⁵

In view of the compelling need for a reform of the fiscal policy governance framework, European policymakers have taken several steps, including the introduction of the "Six-Pack", "Two-Pack" and the Treaty on Stability, Coordination and Governance in the Economic and Monetary Union (TSCG).

The "Six-Pack", consisting of five Regulations and one Directive, hence its name, entered into force on 13 December 2011. It does not only cover fiscal policy surveillance, but also macroeconomic surveillance under the new Macroeconomic Imbalance Procedure (see next section). In the fiscal field, the Six-Pack reinforces both the preventive and the corrective arm of the SGP. For instance, it defines quantitatively what a "significant deviation" from the medium term objective (MTO) or the adjustment path towards it means. Moreover, it enables that an EDP may be launched if a country does not meet the rule for the government debt ratio (i.e. the ratio is above 60% of GDP and does not diminish towards the Treaty reference value at a satisfactory pace). Financial sanctions are imposed in a gradual way, from the preventive arm to the latest stages of the EDP, and may eventually reach 0.5% of GDP. Most importantly, the "Six-Pack" introduces reverse qualified majority voting (RQMV) for decisions on most sanctions. RQMV implies that a recommendation or a proposal of the Commission is considered adopted by the Council unless a qualified majority of Member States votes against it, thereby bringing some automaticity in the procedure.

The "Two-Pack" added two more Regulations, entering into force on 30 May 2013. Its main contribution lies in the preventive arm of the SGP: it obliges governments to submit their (draft) budgetary plan for the coming year to the European Commission. It allows the European Commission to check *beforehand* whether the budgetary plan is in line with its recommendations. If the Commission detects serious shortcomings, it can require a revision of the budget (European Commission, 2012b).

²⁵ This section heavily draws upon De Haan et al. (2012; 2013).

On 1 January 2013, the Treaty on Stability, Coordination and Governance in the Economic and Monetary Union (TSCG) entered into force. The articles in Title III of the Treaty referring to fiscal policy are referred to as “Fiscal Compact”. The two most important elements are a balanced budget rule, including an automatic correction mechanism, and a further strengthening of the excessive deficit procedure. The contracting parties commit to implementing in their national legislation a fiscal rule, which requires the general government structural budget balance to be in line with the country-specific MTO with a lower limit of a deficit of 0.5% of GDP (this limit is 1% if the government debt-to-GDP ratio is significantly below 60% and risks to long-term fiscal sustainability are low). The balanced budget rule must include a correction mechanism, which is automatically triggered in the event of significant deviations from the MTO or the adjustment path towards it. This balanced budget rule must be introduced in the national law of the countries concerned in a binding and permanent way, preferably at the constitutional level.

The “Fiscal Compact” also further strengthens the EDP of the SGP, in particular by increasing its automaticity if a euro area Member State is in breach of the deficit criterion. Most importantly, at each stage of the EDP euro area Member States will support the Commission’s proposals or recommendations in the Council if a euro area Member State is in breach of the deficit criterion, unless a qualified majority of them is against it. Unfortunately, reverse qualified majority voting will not be applied following a breach of the debt criterion by a euro area Member State. As argued by De Haan et al. (2012), it seems that European policymakers still have to learn the lesson from the euro crisis that debt levels are more important than deficits when it comes to the sustainability of the currency union. Furthermore, as pointed out by the ECB (2012), for the new rules to work it is crucial that the Commission uses its increased influence by taking a rigorous approach when assessing fiscal deficits and avoids politically influenced decisions. One of the remaining weaknesses is that the new framework has become rather complicated. There are, for instance, still too many exceptional situ-

ations that can be taken into account when deciding on whether a deficit or debt-to-GDP ratio is excessive, or on whether a Member State has taken effective action.

5.3.2 Macroeconomic Imbalance Procedure

European policymakers have also enhanced the possibilities to monitor and prevent large macroeconomic and financial imbalances within the euro area. Particularly important is the introduction of the Macroeconomic Imbalance Procedure (MIP). The MIP is based on a continuous monitoring of a “scoreboard”, consisting of a set of eleven indicators covering the major sources of macroeconomic imbalances. These include the current account balance, price competitiveness as measured by the change in the real effective exchange rate, as well as the growth of credit and house prices. For each indicator, thresholds have been defined to identify potential imbalances. According to the European Commission, the scoreboard and the thresholds are not applied mechanically, as the scoreboard is complemented by an economic interpretation. The aim of the scoreboard is to identify countries that warrant in-depth analysis in order to determine whether the potential imbalances identified in the early-warning system are benign or problematic. In analogy with the SGP, the MIP has a preventive arm and a corrective arm. Under the preventive arm policy recommendations can be issued by the Council to tackle imbalances early on. Under the corrective arm an Excessive Imbalance Procedure (EIP) may be opened for a Member State if it is deemed to experience excessive imbalances. In that case, the Member State concerned will have to submit a corrective action plan with a clear roadmap consisting of concrete policy measures and deadlines for implementing corrective action. Noncompliance with the Council recommendations may lead to financial sanctions that could eventually reach 0.2% of GDP. All decisions on sanctions are made in the Council via Reversed Qualified Majority Voting (RQMV) in order to increase automaticity.

In addition to the MIP, several other measures should reduce the risk

of financial imbalances in the future. One is the establishment of the European Systemic Risk Board (ESRB), which may issue non-binding recommendations to Member States when risks to financial stability emerge. Another improvement is the (upcoming) introduction of macro-prudential policy frameworks in EMU Member States, including the possibility for European coordination. The Capital Requirements Regulation and Directive (CRR/CRDIV) allows national central banks (NCBs) to decide on the countercyclical capital buffer for banks. If necessary, the ECB Governing Council may overrule these decisions and decide on a stricter buffer.

Although these are important steps in the right direction, their effectiveness is not established yet, and will crucially depend on the actual implementation. Especially the MIP contains several potential weaknesses. First, the discretionary room of manoeuvre is relatively large. There are, for instance, no clear criteria to establish whether an imbalance exists and whether it is excessive or not. Second, the decision in the Council on the existence of an excessive imbalance is not made with RQMV. Third, there is a lot of discussion possible on the necessity and the effects of specific policy measures to contain the imbalances. Giavazzi and Spaventa (2010) point out that it is difficult to conceive of enforceable corrective actions. This increases the risk that recommendations are diluted in the Council. Furthermore, the approach is of much less use for prevention, as the recommendations in the preventive stage of the procedure are non-binding. Recommendations only start to become binding when imbalances are excessive, which means that they are already pretty large and difficult to reverse quickly.

5.3.3 Crisis mechanisms

As pointed out in section 5.2.2, backstop mechanisms have been set up to provide financial assistance to Greece, Ireland, Portugal, Spain and Cyprus. The most important tool to that effect is the European Stability Mechanism (ESM). However, the debate on whether enough has been done to ensure a robust crisis management system is not closed. Several observers have

questioned whether sufficient funds are available. For instance, Lane (2012: 60) argues that “funding [...] was only enough to address the bailouts of Greece, Ireland, and Portugal – and thus not nearly sufficient to offer substantial support to Spain and/or Italy”. Gilbert et al. (2013) argue that as an ESM-style rescue fund is inherently limited in size, it cannot by itself fully rule out contagion between EMU member states. In the current set-up of the ESM (with only a small proportion of pre-funding), this is further amplified by the fact that one country’s (additional) borrowing is another country’s (additional) lending (Bijlsma and Vallée, 2012).

The ECB has also taken on an important role, by means of especially the announcement of the Outright Monetary Transactions programme (OMT). The ECB is capable of providing an effective backstop. However, this is probably not an optimal long-run solution as using OMTs comes with a number of negative side effects in the longer run. The function of lender of last resort could interfere with the ECBs monetary policy mandate and might create inflationary risks. In addition, ECB intervention also comes with risks specific for a central bank in a currency union. Whereas other central banks interact with a single government, after the adoption of the euro by Lithuania in 2015 the ECB interacts with nineteen. When the ECB buys government bonds this inevitably has distributional consequences. Should the ECB incur losses on its bond portfolio, those losses are transferred to its shareholders i.e. the euro area Member States. The ECB thereby becomes a vehicle for fiscal transfers to countries benefiting from the purchases, for which it neither has the mandate nor the democratic legitimacy.²⁶

5.3.4 Banking Union²⁷

Until November 2014, national authorities were responsible for supervising the banking system and ensuring its stability. The crisis has made clear that

²⁶ This is one of the reasons why support from OMTs is explicitly linked to the presence of an adjustment programme from the EFSF/ESM and to the requirement that the programme conditionality is fully respected. This reduces the financial risks for the ECB and ensures that the period of support is used to improve the underlying situation in the country concerned.

²⁷ This section draws on Cavelaars et al. (2013).

this is not a viable arrangement. In line with the financial trilemma (Schoenmaker, 2011) a decentralized system of bank supervision and resolution is inadequate in an environment with a large banking sector and high interconnectedness among national banking systems as well as between banking systems and sovereigns (Obstfeld, 2013). Experience of the near failure of cross-border banks in Europe suggests that in times of crisis national authorities focus on preserving the national parts, while the integrated value of a bank is neglected. Furthermore, a banking union with a common safety can break the "doom loop" between national governments and banks (Gros and Schoenmaker, 2014).²⁸

The European Council therefore decided in June 2012 for a European Banking Union, which involves three elements. First, under the so-called Single Supervisory Mechanism (SSM) micro-prudential supervision of banks has moved from national supervisors to the ECB since November 2014.²⁹ Also non-euro area Member States may participate in the SSM. By giving non-euro area Member States full membership and voting rights in the Supervisory Board the body responsible for the preparation of decisions on supervisory matters they are placed on an equal footing with euro-area Member States. The role of the ECB Governing Council in the SSM is reduced to the possibility of accepting or rejecting the decisions of the Supervisory Board (Constâncio, 2013).

A crucial step towards the new supervisory regime was the large-scale health test of the top 130 banks in the euro area countries, which together

²⁸ Still, some further steps may be required to deal with this problem, notably with regard to the regulatory treatment of government bonds. According to Weidmann (2014), "we need to end the preferential treatment afforded to sovereign debt. At present, sovereign bonds are treated by European regulators as being riskfree an assumption that stands in contradiction both to the no bail out clause and to recent history. We should therefore put this regulatory fiction to rest. Hence, sovereign bonds should be adequately risk-weighted, and exposure to individual sovereign debt should be capped, as is already the case for private debt."

²⁹ Whereas the ECB's direct supervisory responsibility focuses on the largest banks, the national supervisors will remain responsible for supervision of the smaller banks. However, the ECB will be "exclusively competent" regarding the supervision of all banks, setting the overall policy framework, guarding supervisory quality and consistency, and taking over supervision from national supervisors if it deems necessary.

account for some 85% of European bank assets. This so-called comprehensive assessment, consisting of an Asset Quality Review (AQR) and stress tests, aimed to reduce uncertainty on the state of bank balance sheets, which should increase confidence in the banking sector and encourage new lending. The comprehensive assessment should also ensure that the new banking union will not immediately be confronted with large losses from the pre-crisis period.³⁰

Second, a Single Resolution Mechanism (SRM) has been introduced to deal with bank resolution, i.e. the orderly restructuring and/or liquidation of ailing financial institutions. A situation in which only supervision is delegated to the European level, but in which the resolution mechanism remains national could give rise to conflicts of interest. For example, supervisory decisions to withdraw the licence of a bank would be taken at a central level whereas the bill of such decisions would have to be footed at a national level. This would put tremendous pressure on the European supervisor not to pull the trigger but instead to exercise forbearance. The political agreement concluded in March 2014 about a SRM was therefore a major step. The SRM Regulation will be applicable from 2016, together with the bail-in provisions under the Bank Recovery and Resolution Directive (BRRD). Under this mechanism, losses are initially borne by shareholders and creditors. If necessary, temporary financing can be made available from the newly established Resolution Fund or as the ultimate backstop from public funds. The Resolution Fund composed of national compartments for a transitional phase of 8 years is built up over time by contributions from the banking

³⁰ The assessment found a capital shortfall of 25 billion euro at 25 banks. Twelve of the 25 banks have already covered their capital shortfall by increasing their capital by 15 billion euro in 2014. The comprehensive assessment also showed that a severe stress test scenario would deplete the banks top-quality, loss-absorbing Common Equity Tier 1 (CET 1) capital by about 263 billion euro. This would result in the banks' median CET1 ratio decreasing by 4 percentage points from 12.4 to 8.3 per cent. Capital shortfalls should be covered within six months for those identified in the AQR or the baseline stress test scenario, and within nine months for those identified in the adverse stress test scenario. Shortfalls revealed by the AQR and the baseline stress test scenario may only be covered by Common Equity Tier 1 (CET1) capital instruments. The use of Additional Tier 1 (AT1) capital instruments to cover shortfalls arising from the adverse stress test scenario is limited, depending on the trigger point of conversion or write-down.

sector raised at the national level by the national resolution authorities to a funding level of 1% of covered deposits. Its target size of 55 billion euro would be enough to resolve all but the very largest banks in Europe (Gros, 2013). Resolution decisions will be prepared and monitored centrally by a Single Resolution Board (SRB).³¹ The European Commission assesses the SRBs decision and can refer it to the Council if it wishes to depart materially from the Boards proposal.

According to Gros (2013), there are some weaknesses in the SRM, most importantly that there is as yet no explicit agreement on how to provide the SRF with a backstop. In the transition period, bridge financing will be available either from national sources, backed by bank levies, or from the ESM. The ECOFIN decided that a common backstop will be developed during the transition period. Such a backstop will facilitate borrowings by the SRF. The ECOFIN also decided that the banking sector ultimately will be liable for repayment by means of levies in all participating Member States. The backstop only will be fully operational (at the latest) after ten years. Another weakness is that it will take some time for the SRF to reach its target of 55 billion euro. But a long transition period was unavoidable as creditor countries were not willing to accept a mutualisation of the risks from the past (Gros, 2013).

Third, the introduction of a European deposit guarantee scheme. This has received a low priority as national schemes have been harmonized. However, Gros and Schoenmaker (2014: 537) argue for combining resolution and deposit guarantee at the European level as this “allows for swift decision-making. [...] By contrast, a myriad of national funds is difficult to activate during a crisis and may give rise to conflicts. Two separate Euro-

³¹ The Board will operate in two sessions: an executive one and a plenary one. In its executive session, the Board consists of the Chairman, the Vice Chair, the four permanent members and the relevant national authorities where the troubled bank is established. The executive session will adopt individual resolution decisions which involve the use of the Fund below a 5 billion threshold. The plenary session will be competent to decide in individual resolution cases if the support of the Fund in a specific case is required above the 5 billion euro threshold.

pean funds for deposit insurance and resolution may lead to inter-agency conflicts. Recognizing the interconnectedness, the functions of resolution and deposit insurance should be combined in Europe, as is done in the United States.”

5.4 The road ahead

As discussed in detail above, in recent years all major weaknesses in the set-up of the EMU have been addressed in some way or the other, which is a major achievement. However, the effectiveness of the new arrangements is not established yet, and will crucially depend on the implementation in practice. Zooming out, two main facts stand out. First, by and large national sovereignty is preserved, especially in the most visible and politically sensitive areas. Despite improved policy coordination, fiscal and economic policies largely remain national prerogatives. Therefore imposing fiscal and especially macroeconomic discipline on reluctant sovereign states remains challenging. The loss of national sovereignty is larger in banking supervision, but national influence remains relatively large in bank resolution. Second, the introduction of the ESM, the OMTs, and the banking union has significantly increased the degree of risk sharing between EMU Member States, but in a relatively non-transparent and piecemeal way (see Table 5.2). Explicitly visible risk sharing via governments (ESM) remains relatively small, while there is a relatively large role for more implicit risk sharing in case banks face problems (bail-in, resolution fund) and especially via the ECB (VLTROs and OMTs).

In our view, this has two consequences. First, in the longer run the way risk sharing is organized can be improved. Especially the currently large role of the ECB does not seem an optimal long-run solution. Second, an imbalance looms between the degree of risk sharing and the degree of national sovereignty (Weidmann, 2014). This is especially true if the current framework for policy coordination proves insufficiently effective, for instance, due to weak enforcement. If too much sovereignty is retained, this will also

increase the risk of new budgetary, financial and economic imbalances and thereby the chance that risk sharing arrangements will be called upon. This in turn increases the risk that those risk sharing arrangements (like the ESM) turn out to be insufficient or turn out to have too large negative side effects. In this regard, EMUs current combination of a still relatively limited degree of policy coordination in combination with a significantly increased degree of risk sharing could be improved upon. Indeed, several authors claim that the current arrangements provide a half-build house, and that long-term solutions require either a move towards a full political union (Glienicker Gruppe, 2013), or a credible return to the no-bailout clause so that markets can discipline governments (Von Hagen, 2013; Mody, 2013).³²

While we do not argue against intermediate solutions like the current arrangements, in our view further improvements are possible. It would in particular be beneficial to further optimize the balance between risk sharing and national sovereignty. Although many specific institutional settings are conceivable, this almost unavoidably requires a fundamental choice to move closer towards one of two broad solutions sketched in the literature. These are either a monetary union with a higher degree of (explicit) risk sharing and more curtailed sovereignty, or a union of the type referred to by Buiter and Rahbari (2011) as: “you break it, you own it”, where insolvency of a sovereign is settled between the taxpayers of that sovereign and its creditors, without any permanent financial support from any other nations taxpayers. In earlier work (De Haan et al., 2012; 2013, Gilbert et al., 2013) we have argued for Eurobonds, as this in our view is most desirable from a macro-economic viewpoint. It is, however, highly politically sensitive. In the following, we will therefore also describe an alternative: a variant of the “you break it, you own it” Europe based on market discipline and

³² Regarding a political union: this idea stems from the fact that successful currencies have historically always been linked with successful nation states (Goodhart, 1998). Yet, as argued by Hoeksma and Schoenmaker (2011) and Van Riet (2014), the European Union is a supranational arrangement that already performs many tasks that traditionally were the prerogative of nation states. It therefore remains unclear how much more political integration would be necessary to keep the monetary union stable.

Table 5.2. Verdict EMU-variants

	<i>Original) EMU) (Ex-ante)</i>	<i>Original EMU (Ex post)</i>	<i>Enhanced EMU</i>	<i>Eurobonds (section 5.4.1)</i>	<i>No-bailout (section 5.4.2)</i>
Degree of coordination	–	–/–	+/–	+/+	+/–
of Fiscal policy	+/-	–	+	+/+	+/-
of Macroeconomic policy	–	–/–	+/-	+	+/-
of Banking regulation	–/–	–/–	+	+	+
<i>Political feasibility</i>			+/-	–	+/-
Degree of risk sharing	–/–	+	+	+	+/-
via governments (explicit)	–/–	+/-	+/-	+/+	+/-
via banking union (explicit)	–/–	–/–	+/-	+	+
other (implicit)	–/–	+/+	+	–/–	–/–
<i>Political feasibility</i>			+/-	–	+/-
Balance coordination and risk sharing	+	–/–	+/-	+/+	+/+
Economic desirability			+/-	+/+	+

Notes: -/- indicates a complete absence of risk sharing/ policy coordination within EMU; ++ indicates perfect risk sharing/full coordination. In the enhanced EMU both the degree of policy coordination and the degree of explicit risk sharing via the banking union have increased compared to the original set-up; but in both cases questions remain (see section 5.3). As a result, it is yet unclear to what extent the degree of implicit risk sharing (e.g. via the ECB) can be reduced. In the "Eurobonds" scenario as suggested in section 5.4.1, the balance between coordination and risk sharing is restored by strengthening coordination and by making risk sharing more explicit. The balance between risk sharing and coordination can also be restored by limiting risk sharing ("strengthening no bail-out"). This, however, requires a strong banking union and the possibility of liquidity support for governments (section 5.4.2). It is therefore not self-evident that in this scenario policy coordination can be reduced compared to the current status quo.

a formal mechanism for debt restructuring.³³

Yet, both alternatives will only become feasible after current vulnerabilities in the monetary union have been dealt with, in particular the high public debt overhang in many countries. Public debt now stands at 96% of GDP for the euro area as a whole, while five countries have debt levels above 120% of

³³ A larger role for debt restructuring in the euro area does not necessarily require a formal restructuring mechanism. Such a formal mechanism has both advantages and disadvantages. An advantage is that it may prevent restructuring from occurring too late, which could have high costs. This would be the case if uncertainty about restructuring leads to prolonged market turbulence, or if restructuring only occurs once bailouts have already moved most of the debt towards public authorities like the ESM, IMF or ECB. A disadvantage is that a formal mechanism may provide government with an easy way out of a high debt situation, possibly causing debt restructuring to occur too early. It could also increase moral hazard and reduce the prevention of high deficits. There is no consensus on which of these two effects dominates, although Buchheit et al. (2013) believe that the Greek restructuring was too little, too late. In any case, the relative importance of these two effects also depends on the specific shape of a restructuring mechanism.

GDP. Such high levels of debt make Eurobonds costly, as it increases the risk of losses and may lead to a controversial transfer union (Gilbert et al., 2013). Likewise, these high debt levels make large-scale debt restructuring costly as well, as it may require unrealistically large write-offs and could lead to destabilizing contagion towards other Member States (Vihriälä and Weder di Mauro, 2014).

5.4.1 Eurobonds

Eurobonds are centrally issued, jointly guaranteed bonds for financing the euro area Member States public debt. Eurobonds can protect individual Member States against contagion and speculation on financial markets in a more robust and fundamental way than emergency funds, by guaranteeing countries in fiscal difficulties access to market financing. This reduces the risk that liquidity problems turn into solvency problems via higher interest rates, as well as the risk that problems spread from one country to another (Boonstra, 2011; Gilbert et al., 2013).

Clearly, more explicit risk sharing and guaranteed access to finance have a flipside: countries face weaker incentives for keeping fiscal policies sustainable. This requires strict coordination of (fiscal) policy. In our view, Eurobonds can serve as an instrument to achieve this if countries can no longer enter the capital and money markets on their own initiative. All debt needs to be financed with centrally issued Eurobonds. In our proposal (De Haan et al., 2012; Gilbert et al., 2013) the sole issuer of Eurobonds is an independent Budgetary Authority, which is also in charge of the enforcement of the European fiscal rules. It thereby has the exclusive authority over the granting of loans to Member States. As a general rule, access to Eurobonds will be limited to countries with debt levels below a "debt ceiling" of 60% of GDP (De Haan et al., 2012; Gilbert et al., 2013). Member States exceeding this ceiling should be placed in a form of receivership. They would be temporarily allowed to take on extra debt (not on their own, but via the Budgetary Authority) only if they set out a detailed budgetary adjustment program

and stick to it. If the corrections proposed by the debtor nation were insufficient, the Authority would be able to impose corrections. Any country that failed to satisfy the requirements would be denied access to additional finance and would therefore have no choice but to immediately implement further austerity measures. In a system where Eurobonds would be the sole finance vehicle, such a sanction would be much more credible than anything that is currently imposed, because countries would have no access to finance except via the new Budgetary Authority, giving it maximum bargaining power.³⁴

5.4.2 Minimising the degree of risk sharing

The alternative approach of minimising the degree of risk sharing within EMU and relying more on market discipline, requires a more credible commitment to the no-bailout clause and some form of explicit *ex-ante* debt restructuring mechanism for insolvent sovereigns within the euro area (Von Hagen, 2013; Mody, 2013; Buchheit et al., 2013). The proponents of this approach claim several advantages. First, it would reduce uncertainty as well as the cost of restructuring in case of clearly insolvent sovereigns (such as Greece). Second, it might enable a monetary union with significantly less policy coordination and hence constraints on national sovereignty (Mody, 2013). In our view, the crisis has made it clear that eliminating all risk sharing within EMU is not feasible. A fully credible no-bailout is arguably not feasible in a highly financially integrated monetary union where Member States are vulnerable to contagion and self-fulfilling liquidity crises (see section 5.2.4). In such an environment, relying only on market discipline and debt restructuring may cause debt restructuring to occur too soon and too

³⁴ This is also because the Budgetary Authority is able to refuse financing of *additional* debt without putting in doubt the (re)financing of the remaining debt stock. That decision therefore comes with much smaller financial stability risks than in the current practice, where refusal to grant extra financial support may induce remaining (private) creditors to run for the exit.

much.³⁵ This would unnecessarily increase risk premia, borrowing costs and welfare.

One reason for this is that while a debt restructuring mechanism might be beneficial when sovereigns are clearly insolvent, a distinction between illiquidity and insolvency is often impossible to make in practice: there is a grey area where debt sustainability cannot be established with certainty. While countries in a monetary union are more vulnerable to liquidity problems than countries having their own currency, it is less clear whether they are also more vulnerable to solvency problems. On the one hand, EMU countries lack monetary policy and the exchange rate to absorb shocks, which *ceteris paribus* implies lower debt sustainability (Sims, 2012; Buchheit et al., 2013). On the other hand, higher inflation cannot reduce debt in the long run, as it will also affect nominal interest rates (Gross, 2012).³⁶ Therefore, the grey area may arguably be larger for EMU Member States than for other countries, making it harder to fully rely on market discipline and debt restructuring. It would make sovereign debt in the monetary union more explicitly risk-bearing than in other countries.

The uncertainty surrounding debt sustainability would be reduced if EMU countries could agree on a clearly visible threshold above which debt restructuring becomes inevitable (Buchheit et al., 2013). Even then, the risk of self-fulfilling sovereign debt crises still requires the existence of liquidity support for governments (Buiter and Rahbari, 2011; Vihriälä and Weder di Mauro, 2014). A sufficiently large backstop therefore remains necessary.³⁷

³⁵ Interestingly, Flandreau et al. (1998) show that also in previous decades market discipline had the tendency to overshoot. The problem was especially severe in fixed exchange rate regimes, such as the period of the gold standard.

³⁶ Gros (2012) reminds us that before the start of EMU, the monetary union was thought to increase debt sustainability in several countries, as it would reduce nominal interest rates thanks to more credible monetary policy and the absence of competitive devaluations.

³⁷ Although it can be argued that the required size of the backstop may be smaller than the current backstops. This is especially the case when a debt restructuring mechanism is only introduced once public debts have been reduced below the 60% of GDP threshold. The banking union and the possibility of debt restructuring may also reduce the required amount of liquidity support.

Moreover, this also requires a certain degree of coordination of fiscal and macroeconomic policies, in order to prevent excessive reliance on liquidity support. Finally, as the possibility of debt restructuring will reinforce the doom-loop between banks and sovereigns, a well-functioning banking union is needed as well. This could include risk weights and concentration limits of sovereign bond portfolios. In our view, it is therefore not so evident that a debt restructuring mechanism will significantly reduce the required degree of policy coordination in EMU compared to the current status quo.

Chapter 6

Conclusion

6.1 Summary

The European sovereign debt crisis has clearly reinforced the original criticisms on EMU (chapter 1). One criticism was based on *nominal* factors: the fear that the Maastricht treaty did not contain sufficient safeguards for monetary and budgetary discipline. Another criticism was based on *real* factors: the fear that EMU did not meet the criteria for an Optimum Currency Area (OCA) and was therefore vulnerable to asymmetric shocks. At the same time, these criticisms have also missed important aspects that turned out to be crucial during the sovereign debt crisis. One reason for this is that *financial* factors have become much more important.¹ In this thesis we have investigated how several - sometimes controversial - aspects of the functioning of EMU were influenced by the increased role of financial factors in the monetary union. The analyses lead to a number of conclusions and policy implications.

Chapter 2 investigates current account imbalances in EMU. These imbalances turned out to be at the heart of the sovereign debt crisis, but had not been identified as a potential vulnerability by either the architects of

¹ As mentioned in chapter 1, a third line of criticism before EMU started did point to financial factors, such as the lack of European banking supervision. However, this criticism was much less prominent in the debates on EMU at the time. Moreover, this line of criticism also failed to see important aspects of the crisis (see below).

EMU or their critics. This chapter specifically investigates the relative role of price competitiveness (a real factor) and of financially driven demand booms (a financial factor). We find that differences in price competitiveness matter for the evolution of current account balances, but that differences in domestic demand and the financial cycle are more important. We also find that financial cycles and medium-term fluctuations better explain the evolution of current account balances than normal business cycles. An implication is that changes in relative prices may be less crucial for the rebalancing of current account imbalances than often assumed. Proposals like a temporary euro exit are therefore unnecessary and counterproductive. Our results also call for more emphasis on financial factors and macro prudential policy to prevent future current account imbalances, in addition to the attention for competitiveness, wage and price flexibility and structural reforms.

Chapter 3 looks at the symmetry of fluctuations in EMU. Normal short-term fluctuations have often been central in the application of the OCA theory to EMU. Yet their surprising symmetry is hard to reconcile with the sovereign debt crisis. We try to solve this puzzle by looking at medium-term fluctuations instead. We find that these fluctuations are less symmetric than short-term fluctuations. Medium-term fluctuations have also become less symmetric over time, while short-term fluctuations became more symmetric. We also find that medium-term fluctuations have become more strongly correlated with financial variables (credit and house prices) and less strongly correlated with real variables (productivity). This increases the risks of imbalances and crises. Indeed, medium-term fluctuations are more closely related to imbalances in price competitiveness and current accounts than short-term fluctuations. Our medium-term perspective has become relevant for EMU, because of the increased influence of financial factors. It leads to less benign views on the functioning of EMU as an OCA. It also implies that growth divergences are larger than often assumed. EMU could therefore benefit from a clearer medium-term perspective in macroprudential, monetary and budgetary policy frameworks.

Chapter 4 investigates the nature of the increase in European sovereign bond yields during the debt crisis. While the architects of EMU had been suspicious of the disciplining effect of financial markets (European Commission, 1990, see chapter 1), it came as a surprise to almost everyone how strongly yields rose and how quickly the turmoil spread from one member state to another. There is still no consensus on the exact nature of these fluctuations in yields. We examine the extent to which sovereign yields can be attributed to macroeconomic fundamentals. We find that bond yields do display large fluctuations that cannot be explained by fundamentals. This suggests that some mispricing and overshooting took place. At the same time, the outcomes are strongly affected by modelling choices with regard to i) the confidence bands for the model prediction, ii) the assumption whether the model coefficients are similar across countries or not, iii) the sample selection, iv) the inclusion of financial variables and v) the choice of time-varying coefficients. The precise extent to which bond yields are misaligned is therefore highly uncertain. A policy implication is that EMU member states may experience destabilising liquidity problems on their sovereign bond market. Therefore, some financial support mechanisms like the European Stability Mechanism (ESM), ECB interventions like the OMT or an areawide safe asset are needed for financial stability in the monetary union. At the same time, the model uncertainty makes it impossible to fine-tune interventions, that will always require a degree of judgement.

Chapter 5 discusses the reforms to the institutional setup of the monetary union since the crisis. Against the background of the increased importance of financial factors in the monetary union, major weaknesses in this set-up of EMU appeared. The financial factors amplified some of the vulnerabilities that had already been mentioned by EMU's critics, but also led to new ones that had not been foreseen. All weaknesses have led to policy measures to improve the situation. In a short time, policymakers introduced a revised Stability and Growth Pact (SGP), a new Macroeconomic Imbalances Procedure (MIP), the European Stability Mechanism (ESM) and European mechanisms for banking supervision (SSM) and resolution (SRM).

This is a major achievement, but the effectiveness crucially depends on strict implementation. As this is not guaranteed, an imbalance looms between the degree of risk sharing ("liability") and the degree of national sovereignty ("control"). Improving this balance requires a fundamental choice between either a monetary union with a higher degree of (explicit) risk sharing and more curtailed sovereignty, or a more decentralized union based on market discipline and forms of public debt restructuring.

Our analyses show that the increasing importance of financial factors have both reinforced and *changed* the prevailing criticisms on the monetary union. From the nominal side, it was true that the Maastricht treaty did not contain sufficient safeguards for budgetary discipline. Yet partly due to the increasing importance of financial factors, policy discipline also proved necessary in other areas of policymaking. In a monetary union, it turned out to be important to prevent imbalances in macro-financial areas like house prices and current accounts (chapter 2) from becoming a source of asymmetric shocks that could spill over to the union as a whole. This required restrictions on member states' policies in areas like price and wage setting, banking supervision and macroprudential policy. From the real side, it was true that EMU was not sufficiently close to an optimum currency area. Yet due to the increasing importance of financial factors and financial cycles, the asymmetries proved much larger and longer lasting than envisaged before EMU started (chapter 3). The incomplete setup of EMU did not only find it difficult to deal with these larger asymmetries, it even turned out to *amplify* them.² For example, the vulnerable countries suffered from a destabilising increase in bond yields (chapter 4). Moreover, the increase in financial integration before the crisis started to reverse and many banks and governments experienced funding difficulties.

² The incomplete setup of the monetary union itself has *endogenously* contributed to asymmetries. The incomplete setup of EMU has amplified the buildup of macro-financial imbalances that became a *source* of shocks (chapters 2, 3 and 5). Moreover, the incomplete setup has also influenced the *size and propagation* of these asymmetric shocks once they occurred (chapters 4 and 5). This may be repeated in the future, either because new imbalances build up, or because new purely external shocks - like the coronavirus - play out asymmetrically via the incomplete setup of EMU.

6.2 Further research

Our analyses have added to the growing literature on the influence of financial factors on the functioning of EMU. We present three suggestions for further research. First, it would be useful to determine more systematically and quantitatively how much of the problems in the eurozone actually result from the incomplete setup of the monetary union itself. As chapter 1 mentions, EMU started when almost all advanced economies experienced a period of rapid financial development and integration. As a result, many countries outside EMU have also suffered from financial imbalances like credit booms, house price bubbles and current account deficits (Hessel and Peeters, 2011). It therefore seems likely that European member states would also have experienced a severe crisis without EMU. This would equally have led to severe tensions within the single market, such as exchange rate crises and destabilising capital flows. The increasing frequency and severity of exchange rate crises in the 1980s and 1990s is a clear reminder of this (chapter 1). The literature underlines that some contributing factors are stronger inside the monetary union. For example, due to the single monetary policy, persistent inflation differentials caused long lasting differences in real interest rates that amplified divergences in credit growth and current account balances (Bonam and Goy, 2017, chapters 2 and 3). Likewise, vulnerabilities like the fragility of debt financing in the monetary union, the initial lack of crisis instruments (like financial safety nets) and the strength of the sovereign-bank nexus have added to capital flight (chapter 4 and 5). At the same time, some other mechanisms in EMU have softened the blow: the financial aid that became available via the ESM and the ECB (Gross and Alcidi, 2015b). For a more systematic insight into the contribution of EMU, model simulations like in Martin and Philippon (2017) are a good starting point. More detailed and systematic comparison with the US - a more "complete" monetary union - as in chapter 2 is also needed.

Second, it would be very useful to know better how likely the debt crisis will be repeated in the future. Did the buildup of macro-financial imbal-

ances like current account deficits (chapter 2) and the related medium-term fluctuations (chapter 3) in the euro area result from an unfortunate combination of financial factors that is relatively rare? Or are they an inherent feature of the monetary union and can we expect more imbalances, asymmetric shocks and crises? Of course this is a difficult question to answer, but we can gain more insights. Some factors that contributed to the buildup of imbalances before the crisis are clearly one-off. These include the strong decrease in long-term interest rates in the run-up to EMU membership (Gilbert and Pool, 2016). The strong upswing of the global financial cycle may also have been exceptional. Other contributing factors are however more likely to be repeated. Financial developments could remain asymmetric due to differences in financial systems between member states. High inflation persistence continues to strengthen and prolong real interest rates differentials (European Commission, 2015). More research into the relative contribution of each of these factors is welcome.

Finally, a question for further research is how financial factors can be incorporated more systematically into analytical frameworks for the monetary union, in particular the theory of optimum currency areas (Alcidi, 2017). The OCA theory is almost solely based on real factors (chapter 1). The bulk of it was developed in the 1960s and 1970s, when financial sectors and capital accounts were heavily regulated, and financial factors had little separate influence on the economy. But now that this has changed, we lack clear criteria on how the influence of financial factors should be contained and a smooth functioning of EMU can be ensured. Of course relevant literature has grown and policymakers have already found some practical solutions with mechanisms like the banking union and the ESM. At the same time, a more systematic assessment remains welcome, as open questions remain. How important is a federal budget when financial factors contribute to relatively large asymmetries between member states? Should macro-prudential policy be coordinated at the European level, or can it be left to member states? What degree and what type of financial integration is most suitable for a smooth functioning monetary union?

6.3 Implications for EMU

Another issue is what our conclusions imply for the current debates on the future of EMU.³ It remains hotly debated whether the reformed monetary union will be able to withstand new shocks and crises.⁴ In recent years, discussions on measures that would further strengthen the monetary union have continued (Bénassy-Quéré et al., 2018). Political agreement on new measures sometimes proved difficult when the immediate threat from the crisis was over. However, the urgency of the debate has increased considerably now that the coronavirus is causing another severe economic shock.

European policymakers have already significantly strengthened EMU, taking on board a significant part of the recommendations from our analysis (chapter 5, paragraph 6.1). From the nominal side, policy discipline has been increased and expanded to new areas. Budgetary rules were strengthened, while the new macroeconomic imbalance procedure (MIP) should prevent economic and financial imbalances. Countries have also introduced macroprudential policy frameworks that enable them to impose higher (cyclical) capital requirements on banks. From the real side, these improvements should reduce the risk of asymmetric shocks and fluctuations. Further measure reduce the risk that EMU acts as an amplifier of shocks. The banking union loosened the ties between banks and governments. The Single Supervisory Mechanism (SSM) ensures consistent supervision, while the Single Resolution Mechanism (SRM) improves the resolution of banks in distress and ensures that private creditors will bear some cost in a bail-in procedure. Various financial safety nets should prevent and mitigate future financial turbulence. Financial support may come from governments via the Euro-

³Please note that this paragraph (6.3) and the next one (6.4) contain elements that are also mentioned in Hessel et al. (2017), Council of State (2017) and Council of State (2019). I was co-author of these last two reports.

⁴Chapter 5 already answers part of this question, and states that one of the crucial elements for the success of the current setup is the enforcement of and compliance with the new framework. That chapter is already published in its entirety as De Haan, Hessel and Gilbert (2016), as mentioned in chapter 1. We therefore chose not to add any additional considerations to chapter 5, but to discuss them here in the conclusion instead.

pean Stability Mechanism (ESM), or from the ECB via its outright monetary transactions (OMT) program (Hessel, 2020). All in all, EMU has clearly become more stable. For example, sovereign bond markets so far remained fairly stable after the Coronacrisis.⁵

Nevertheless, the economic resilience of EMU needs further improvement (Hessel et al., 2017).⁶ From the nominal perspective of the Maastricht treaty, policy discipline still needs further improvement. There is lack of compliance and enforcement of the reinforced framework (Council of State, 2017; 2019). While compliance with the Excessive Deficit Procedure of the SGP is reasonable (Gilbert and De Jong, 2018), countries are regularly granted extensions to achieve their targets, and compliance with the preventive arm is much lower. Also the implementation of policy recommendations under the MIP and other areas of the European Semester leaves much to be desired in almost all countries, including Germany and the Netherlands (Gros and Alcidi, 2015a). As a result, several imbalances remain, including high public debt in many countries, and new ones are more likely to emerge.

From the real perspective of the theory of optimum currency areas, these imbalances are either a source of asymmetric shocks or reduce the adjustment capacity to other shocks. The Coronacrisis is a case in point. The crisis is essentially a large symmetric shock, but as public debt remains high in some countries, asymmetries may emerge. High-debt countries either lack the fiscal capacity to effectively counter the shock, or risk that public debt sustainability is called into question when they do. Moreover, also the improved setup of the of the monetary remains incomplete and is not able to sufficiently smoothen the resulting asymmetric fluctuations. For example, the risk of capital flight and financial turbulence remains relatively high in

⁵ Although this arguably required an explicitly renewed commitment from Christine Lagarde to Mario Draghi's "whatever it takes" statement. Moreover, the ECB also introduced a new Pandemic Emergency Purchase Program (PEPP) for national government bonds.

⁶ Economic resilience implies that both individual countries as the monetary union as a whole manage to prevent asymmetric shocks and crises as much as possible, and manage to adjust to the shocks that do occur (European Commission, 2016).

the monetary union, for instance because the banking union is not finished yet and a budgetary stabilisation fund at the federal level is missing. Therefore, member states remain more likely to face costly asymmetric shocks and long periods of adjustments in the current setup of EMU. This could eventually erode support for the single currency.

The lack of economic resilience also affects political resilience: future shocks could again lead to disagreement and mistrust between member states. It could therefore help to adjust the tilted balance between liability and control (chapter 5). At the moment, financial safety nets like the ESM have clearly increased public risk-sharing and therefore joint European liability for distressed countries. Yet due to lack of enforcement of the rules of, for example, the SGP and the MIP (insufficiently effective European control) the risk remains substantial that new shocks and crises will require more reliance on public risk-sharing. Some member states may perceive that risk-sharing leads to transfers that become permanent or always go in the same direction. Other member states may perceive the conditionality attached to risk sharing as harsh and burdensome for their economies. This constellation may increase disagreements and mistrust and lead to suboptimal decisionmaking. At the start of the Coronacrisis for example, proposals for crisis measures like coronabonds or ESM-loans with reduced conditionality proved controversial and divisive. Such a lack of political resilience could in the long run reduce support for the euro on both sides of the spectrum.

There are two fundamental directions to strengthen EMU (chapter 5; Council of State, 2017). The first is far-reaching European integration towards a political union with a further transfer of powers to the EU to enforce sound policies. The proponents of further integration typically also call for more solidarity, for example by introducing eurobonds or a budgetary stabilisation fund. The second solution is less integration and a return to the no-bailout clause in the Maastricht Treaty (Mody, 2013; Sandbu, 2015). Countries that get into trouble will no longer be rescued, but will face a restructuring of their government debt. This should reduce public risk-

sharing and strengthen market discipline. European control over national policies could then even be scaled back.

The problem is that both directions are difficult at the moment. Further integration is highly controversial in many countries. As long as countries are unwilling to really transfer sovereignty to the European level, divergences and imbalances will remain. Additional risk sharing would then even further skew the balance between liability and control. A major reversal of European integration is, however, equally controversial, and a full return to no bailout could entail high costs (Council of State, 2017). Market discipline did not lead to sound budgetary policies before EMU, and already the European Commission (1990) knew that markets can be overly optimistic or pessimistic (chapter 4). Without at least some financial safety nets, countries are vulnerable to liquidity crises, contagion and capital flight (Council of State, 2017).

6.4 Future improvements

Nevertheless, smaller measures could already substantially improve the situation. A first range of measures could further improve the policy discipline that was strengthened and expanded after the crisis (chapter 5). From the nominal perspective of the Maastricht treaty, this will help to prevent the emergence of imbalances that are a source of asymmetric shocks and crises (chapter 2) and require politically sensitive forms of risk sharing. From the real perspective of the OCA theory, it will help to reduce the size and duration of asymmetric fluctuations and financial cycles (chapter 3). Therefore, compliance with and enforcement of current SGP and MIP rules should be improved as much as possible (Council of State, 2017). For one, rules must be simplified, as the framework has become too complex with too many objectives (Eyraud et al., 2017).⁷ Rules should also focus more closely on

⁷For example, the current budgetary rules set criteria for the actual budget balance, the cyclically adjusted budget balance, government debt and real expenditure growth.

the most harmful imbalances and spillovers, rather than on fine-tuning every situation. It would also help to limit the number of exceptions and to set clear criteria for discretions.⁸ Finally, enforcement could be strengthened via European networks of national independent authorities. This would help to cope with the current politicized enforcement and contribute to support at the national level (Wyplosz, 2015). While all this will improve the situation, it will always remain difficult to bind democratic sovereign countries with European rules in “political” areas like budgetary and economic policy. In a way, the original criticism that EMU needs a political union remains relevant. Enforcement and compliance in these areas will always remain imperfect in the current framework.⁹

Given these imperfections in enforcement, it seems wise to retain at least some role for market discipline (Council of State, 2019). While it is dangerous to fully rely on the disciplining effect of markets (chapter 4), it is possible to strengthen the role of the no-bailout clause again. That would also reduce the reliance on public support mechanisms and ensure that more risks will be borne by the private parties that originally took them. An important step is to facilitate the resolution of unsustainable government debts. This implies a *partial* return to the no-bailout clause in the Maastricht Treaty (Sandbu, 2015), improving the balance between liability and control. To re-

⁸ Under the SGP, it is not always clear how the Commission assesses whether a country has taken effective action towards reducing its deficit. Similarly, under the MIP, it unclear on what basis the Commission decides that an imbalance is excessive.

⁹ The enforcement of European rules works better in areas like competition policy, where decisions are made by the Commission (instead of the Council) and parties can appeal at the European Court of Justice. One reason for this is that this field is relatively technical and requires specific expertise. Even at the national level, many countries delegate such tasks to (quasi) independent authorities (Alesina and Tabellini, 2007). By contrast, especially budgetary policy is much closer to the political process, as it touches on the fundamental right of parliaments to decide on the budget. Countries have often been reluctant to involve independent “bureaucrats” in these areas even at the national level, and are therefore equally hesitant to transfer sovereignty to the European level. The Council of State (2017, 2019) observes that more involvement of the European Court of Justice in the enforcement of budgetary rules is theoretically possible, but politically difficult. Moreover, a judge is a less appropriate body when it comes to policy choices. In previous cases the Court of Justice has been cautious in detailed assessments of such choices (see for example its 2004 ruling on the excessive deficit procedure (C-27/04) and its 2012 ruling on the ESM-treaty (C-2012/756)).

inforce the no-bailout clause in a credible way, it is key that member states and financial markets are convinced it will be adhered to (Corsetti et al., 2016). This requires a clear mechanism with ex-ante rules to write down unsustainable public debts before a country relies on the ESM or the ECB for financial support. Then all parties know in advance that liquidity support is available, but that the union will not take over unsustainable debts. If an analysis shows that debt sustainability is doubtful, bonds should be restructured along pre-agreed rules that include automatic maturity extensions or the write-down of outstanding bonds.

A second range of improvements is beneficial from the real perspective of the theory of optimum currency areas. The monetary union should become better in dealing with the relatively large asymmetric fluctuations (chapter 3) and the setup of EMU should no longer amplify asymmetric shocks via for instance destabilising increases in bond yields (chapter 4). One necessary improvement to achieve this is to further limit the damage that future crises may do to the banking sector. Several measures could improve financial stability and the resilience to shocks. They would also make restructuring of government debts less difficult and hence the partial return to no-bailout clause more credible. It would also lower banks' reliance on public risk sharing mechanisms, like the long-term liquidity provision by the ECB (Hessel, 2020). It is important to further finish the banking union with the establishment of some form of European deposit insurance scheme, making depositors less likely to withdraw funds during difficulties. A common backup structure for the single resolution fund is also necessary. Furthermore, it is very important to tighten the rules for government bonds on bank balance sheets, in order to reduce the sensitivity of banks to any problems of their own national governments (Dell'Ariccia et al., 2018). While current regulation treats government bonds as risk-free, the crisis has proved that this is not always the case. Banks should maintain more capital for such bonds (risk weights) and be dissuaded to invest excessively in one single government (concentration limits).

In addition, encouraging more robust financial integration could further improve financial stability, resilience and private risk sharing during future asymmetric shocks and crises. Even though financial integration has strongly increased since the start of EMU (chapter 1), capital flows have been unstable during crises and private risk sharing is underdeveloped compared to for example the US (Bijlsma and Hessel, 2016). Therefore, it is crucial to continue with an ambitious implementation of the European Capital Markets Union (CMU). Integration of equity and capital markets lags far behind the US. Cross-border capital flows should consist less of debt and more various forms of equity in the private sector. Market-based finance should increase more generally, as lending in the euro area currently depends heavily on banks, which tend to reduce lending during crises due to balance sheet problems (Langfield and Pagano, 2016). In addition, banks should become less dependent on their national economies (Hofmann and Sørensen, 2015). Banking integration should not rely on cross-border inter-bank (wholesale) funding, but on actual cross border bank operations.

While these measures will further improve the functioning of EMU, they do not ensure that the monetary union reaches its full potential (Hessel et al., 2017). The Coronacrisis has reinvigorated the debate on two additional measures, that imply further public risk-sharing are are therefore politically sensitive.¹⁰ EMU would be able to deal better with asymmetric shocks with a budgetary stabilisation fund at the European level. As long as some member states face high debts and a large budgetary adjustment burden, they have little scope to counter asymmetric shocks. A fiscal stimulus for EMU as a whole will also be difficult to achieve in these circumstances (Claeys et al., 2016). This could lead to an ineffective policymix for EMU as a whole, leaving the bulk of macroeconomic policy to the ECB. It would therefore be beneficial if central budgetary stimulus was provided at the European level, and also if some budgetary redistribution between member states took place

¹⁰ We will therefore likely see much more heated discussion on the exact design of these measures and the conditions under which they can be implemented, and they may not even be politically feasible at all for some time. This may only change in the longer run, when compliance with the rules has increased and public debt levels have decreased further.

(Bénassy-Quéré et al., 2016). At the same time, policymakers should be very well aware that a budgetary stabilisation fund will be difficult to achieve in a way that makes it effective and does not result in politically sensitive permanent one-way redistribution. Short-term fluctuations in EMU are surprisingly symmetric, so that a fund based on these fluctuations would not help much (Gilbert and Hessel, 2014). The asymmetric fluctuations in EMU are of a medium-term nature (chapter 3), but a stabilisation fund that targets these fluctuations is much more likely to result in long-term or permanent redistribution. The specific design of such a fund may alleviate this problem somewhat, but policymakers essentially need to be ready to accept this.

Another hotly debated improvement is an area-wide safe asset. The first option on the table were Eurobonds (recently called Coronabonds), centrally issued, jointly guaranteed public bonds for funding (Gilbert et al., 2013). Later less far-reaching proposals were made, including Sovereign Bond Backed Securies (SBBS) that would bundle and tranch national government paper without public risk sharing (ESRB, 2018) or E-Bonds, centrally issued bonds by the ESM with senior credit status (Leandro and Zettelmeyer, 2019). In theory, safe assets have substantial benefits for financial stability. They could end financial fragmentation and the variation in sovereign yields among countries, and could help to further loosen the ties between banks and national governments. Yet in practice these proposals all have substantial drawbacks. They could lead to moral hazard and (depending on the exact design) transfers between member states. Moreover it is not guaranteed that safe assets like SBBS and E-bonds can be designed in a way that stabilizes national bond markets. For example, features like senior credit status affect the (perceived) sustainability of the remaining debt, and could therefore also increase the volatility of national bonds during crises (Gilbert et al., 2013). For this reason, SBBS were controversial even in Southern European countries. It seems unlikely that safe assets can be designed in a way that avoid all practical drawbacks.

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Nederlandse samenvatting

De Europese schulden crisis, die de Economische en Monetaire Unie (EMU) op haar grondvesten deed schudden, kwam zeer onverwacht. Dat kwam niet omdat mogelijke kwetsbaarheden in de opzet van de muntunie onbekend waren: bij de start van de EMU in 1999 had al kritiek geklonken vanuit verschillende hoeken. Maar een verrassend succesvol eerste decennium had geleid tot enorm optimisme over de EMU. In juni 2008 liet de Europese Commissie (2008a,b) bijna euforisch weten dat de structurele begrotingstekorten zich op het laagste niveau bevonden sinds de jaren zeventig, en dat de EMU een klinkend succes was. Achteraf gezien kwamen deze uitspraken slechts een paar maanden voordat het faillissement van Lehmann Brothers de wereldwijde financiële crisis inluidde.

De financiële crisis in 2008 had niet onmiddellijk effect op het functioneren van de EMU. De eerste golf van financiële turbulentie raakte vooral de grote, internationaal georiënteerde banken in landen als Frankrijk, België en Nederland. De meer binnenlands georiënteerde banken in Zuid-Europa bleven in die fase relatief ongeschonden. Dit veranderde echter toen een correctie optrad van de macro-financiële onevenwichtigheden die zich binnen de muntunie hadden opgebouwd. De lont in het kruitvat was dat het Griekse begrotingstekort in 2009 veel hoger uitpakte dan eerder was aangekondigd. Risicopremies schoten omhoog en er trad besmetting op naar andere kwetsbare landen als Spanje, Ierland, Portugal en Italië. Al snel hadden banken en overheden in meerdere lidstaten moeite om zich te financieren. Ondanks een reeks crisisbijeenkomsten van Europese regeringen werd de schulden-

crisis langzaam een bedreiging voor het voortbestaan van de muntunie. Het tij begon pas te keren na Mario Draghi's bekende speech in de zomer van 2012 en de aankondiging van het OMT-programma door de ECB.

De Europese schulden crisis leidde tot een begrijpelijke herwaardering van de oorspronkelijke kritiek toen de EMU begon. Drie lijnen van kritiek zijn in het bijzonder relevant. Een eerste lijn van kritiek richtte zich op politiek-economische factoren. Er werd betwijfeld of de institutionele opzet van de EMU voldoende geloofwaardig was om te zorgen voor macro-economische beleidsdiscipline. Men vreesde dat de nieuwe ECB de inflatie niet zo goed laag zou kunnen houden als de illustere Bundesbank. Ook was onduidelijk of de regels van het Stabiliteits- en Groeipact (SGP) effectief genoeg waren om ervoor te zorgen dat landen ook na EMU-toetreding hun overheidsfinanciën binnen de afgesproken grenzen hielden (Schuknecht et al., 2011). Sommigen vonden het een vergissing dat de convergentiecriteria uit het verdrag van Maastricht om politieke redenen ruim werden geïnterpreteerd en de EMU startte met een relatief grote groep landen. Anderen waren van mening dat de EMU uiteindelijk een politieke unie nodig zou hebben om succesvol te zijn (Feldstein, 1997).

Een tweede lijn van kritiek was gebaseerd op de zogeheten theorie van optimale valutagebieden (Mundell, 1961). Velen beargumenteerden dat de EMU niet voldeed aan de criteria voor zo'n optimaal valutagebied (Brakman en Garretsen, 1996). Europese lidstaten liepen een groter risico op landspecifieke (asymmetrische) schokken dan staten in de VS (Bayoumi en Eichengreen, 1993), en hadden bovendien minder aanpassingsmechanismen om met deze schokken om te gaan. Zowel de arbeidsmobiliteit als de flexibiliteit van lonen en prijzen waren lager in Europa (Décressin en Fatás, 1995), en een Europese federale begroting ontbrak (Sala-i-Martin en Sachs, 1992). Dit zou het functioneren van de EMU bemoeilijken. Deze kritiek op basis van de theorie van optimale valutagebieden bleef overigens niet onbetwist. Sommigen dachten dat de euro zou zorgen voor handelsintegratie en daarmee vanzelf voor meer symmetrische fluctuaties (Frankel en Rose, 1998).

Deze hypothese van het endogene optimale valutagebied" werd enthousiast omarmd door veel beleidsmakers toen de EMU begon.

Een laatste lijn van kritiek richtte zich op de bankensector, al kreeg deze benadering destijds veel minder aandacht dan de andere twee. Folkerts-Landau en Garber (1992) vreesden dat de EMU kwetsbaar zou zijn bij een bankencrisis, omdat onduidelijk was of de ECB zou optreden als *lender of last resort*. James (2013) beschrijft hoe vooral het Europese Comité van Centrale Bankpresidenten ook het bankentoezicht Europees wilde beleggen. Dit idee stuitte echter op zoveel (politieke) weerstand, dat het in een la belandde. Dat werd destijds niet als een probleem gezien: in het bekende rapport "One Market, One Money" (Europese Commissie, 1990) komt de term "supervision" maar één keer voor in een voetnoot.

Achteraf gezien hadden al deze drie vormen van kritiek terecht kwetsbaarheden gezien in de opzet van de EMU. Dat wil niet zeggen dat de EMU een slecht idee was. Ten tijde van het Verdrag van Maastricht waren er belangrijke economische en politieke redenen voor een muntunie. Economisch maakte de toegenomen kapitaalmobiliteit landen steeds kwetsbaarder voor wisselkoerscrises, waardoor ze niet volledig konden profiteren van de gemeenschappelijke markt. Daarnaast vormde de Duitse eenwording een belangrijke (geo)politieke reden om Duitsland steviger in Europa te verankeren. Niettemin is nu duidelijk dat beleidsmakers destijds te optimistisch waren en te gemakkelijk dachten over de kritiek.

Toch is het ook niet zo dat alle huidige problemen al voorzien hadden kunnen worden voordat de EMU begon. De oorspronkelijke kritiek op de muntunie lijkt op het verhaal over de geblinddoekte mensen en de olifant: iedereen beschrijft een gedeelte adequaat, maar niemand ziet het geheel. Veel aspecten van de Europese schulden crisis kunnen evenmin worden verklaard door de oorspronkelijke kritiek op de EMU. Zo kwamen de budgettaire problemen tijdens de crisis niet zozeer door gebrekkige begrotingsdiscipline, maar doordat de crisis zorgde voor een veel grotere verslech-

ring dan waar de begrotingsregels rekening mee hielden (Gilbert en Hessel, 2014). En hoewel de theorie van optimale valutagebieden waarschuwde voor het abstracte gevaar van asymmetrie, wees bijna niemand op de divergenties die in de crisis cruciaal bleken: die in lopende rekeningsaldi en in de groei van kredietverlening en huizenprijzen. Kortom: zowel de architecten van de EMU als hun critici hadden belangrijke aspecten over het hoofd gezien.

De reden hiervoor is dat de tektonische platen in de economie aan het verschuiven waren. De opzet van de EMU was vooral gericht op *nominale* factoren als inflatie en begrotingssaldi. Daar lagen immers de belangrijkste macro-economische problemen in de jaren zeventig en tachtig. De kritiek op basis van de theorie van optimale valutagebieden ontwikkeld in de jaren zestig was vooral gericht op *reële* factoren, zoals asymmetrische schokken en aanpassingsmechanismen. De afgelopen decennia zijn echter *financiële* factoren veel belangrijker geworden in de economie. Deze fundamentele verschuiving komt door de deregulering van financiële sectoren en de liberalisering van het internationale kapitaalverkeer sinds begin jaren negentig. De start van de EMU viel toevallig samen met een periode van zeer snelle financiële ontwikkeling en integratie in de wereld, in Europa nog verder gestimuleerd door de gemeenschappelijke munt (Forbes, 2012). Het sterk toegenomen belang van financiële factoren beïnvloedde ook het functioneren van de EMU, die daar onvoldoende op was toegerust. Het versterkte kwetsbaarheden die al aanwezig waren, en creëerde ook nieuwe kwetsbaarheden die niet waren voorzien (Lane, 2013; Obstfeld, 2013).

Dit proefschrift onderzoekt verschillende aspecten van het functioneren van de EMU in het licht van dit toegenomen belang van financiële factoren. Het betreft onder andere het ontstaan van grote tekorten en overschotten op de lopende rekening, de asymmetrie van fluctuaties in de EMU en de sterke stijging van rentes op staatsobligaties rond het hoogtepunt van de eurocrisis. Al deze aspecten waren controversieel en zijn daarom uitvoering bediscussieerd sinds het begin van de crisis. We laten zien dat ze alleen goed

begrepen kunnen worden als het toegenomen belang van financiële factoren in de analyse betrokken wordt. Dat is niet alleen cruciaal om de (politieke) controverses rond deze aspecten te begrijpen, maar ook om de juiste conclusies over de toekomst van de EMU te trekken.

Hoofdstuk 2 onderzoekt de onevenwichtigheden op de betalingsbalans binnen de EMU: de toenemende tekorten op de lopende rekening in Zuid-Europa en de toenemende overschotten in Noord-Europa. Dit was één van de kernproblemen tijdens de Europese schuldencrisis, maar er is geen consensus over de oorzaken. Sommigen wijzen de onevenwichtigheden toe aan verschillen in prijsconcurrentieposities, een reële oorzaak (Europese Commissie, 2009). Dit leidt tot pleidooien voor structurele hervormingen om de aanpassing van lonen en prijzen te versnellen (Biroli et al., 2010), maar ook voor een tijdelijk vertrek uit de EMU (Sinn en Sell, 2012). Anderen wijzen juist op een financiële oorzaak: verschillen in de groei van de binnenlandse vraag vanwege verschillen in de ontwikkeling van besparingen, kredietverlening en huizenprijzen (Wyplosz, 2013). Volgens hen zouden de onevenwichtigheden zich deels automatisch corrigeren, als huishoudens en bedrijven overgaan tot afbouw van schulden. Een verandering in relatieve prijzen speelt hierbij slechts een kleine rol. Omdat beide oorzaken verschillende implicaties hebben, onderzoeken we de rol van prijsconcurrentieposities en financieel gedreven binnenlandse vraag bij de betalingsbalansonevenwichtigheden.

We schatten verschillende modellen voor het saldo op de lopende rekening of belangrijke componenten daarvan. Bij de verklarende variabelen nemen we de prijsconcurrentiepositie op en een maatstaf voor de binnenlandse vraag of de financiële cyclus. Eerst schatten we prijs- en inkomenselasticiteiten in panel modellen voor handelsstromen. Daarna regresseren we de handelsbalans en het saldo op de lopende rekening op een aantal fundamentele en cyclische oorzaken. Nieuw is dat we diverse maatstaven opnemen voor de financiële cyclus en andere middellange termijn fluctuaties (Stremmel, 2015; Alcidi, 2017), in plaats van de "nor-

male"conjunctuurcyclus. Vervolgens bepalen we in elk model hoeveel de reëel en de financieel gedreven oorzaken bijdragen aan de (componenten van) het lopende rekeningsaldo.

We vinden dat verschillen in prijsconcurrentieposities van belang zijn voor de ontwikkeling van de lopende rekeningsaldi in de EMU, maar dat verschillen in de binnenlandse vraag en de financiële cyclus belangrijker zijn. Het opnemen van de financiële cyclus vermindert het geschatte belang van de prijsconcurrentiepositie. We vinden ook dat financiële cycli en middellange-termijn fluctuaties de lopende rekeningsaldi beter verklaren dan normale conjunctuurcycli. Dit resultaat vraagt om meer aandacht financiële onevenwichtigheden en macro-prudentieel beleid, naast de aandacht voor concurrentiekracht en structurele hervormingen.

Hoofdstuk 3 onderzoekt de symmetrie van fluctuaties in de EMU. De normale korte-termijn fluctuaties zijn verrassend symmetrisch in het eurogebied, zelfs tijdens de crisis. Dit leidt doorgaans tot positieve oordelen over het functioneren van de EMU als optimaal valutagebied (Campos and Macchiarelli, 2016). Die conclusie lijkt echt moeilijk te rijmen met de Europese schulden crisis, die gepaard ging met hardnekkige divergenties in de groei van kredietverlening, huizenprijzen, prijsconcurrentieposities, lopende rekeningsaldi en begrotingstekorten. We proberen deze puzzel op te lossen door te kijken naar middellange-termijn fluctuaties in plaats van naar korte-termijn fluctuaties (Blanchard, 1997; Comin en Gertler, 2006; Drehmann et al., 2012).

Onze hypothese is dat een analyse van deze middellange-termijn fluctuaties leidt tot een minder positief oordeel over het functioneren van de EMU als optimaal valutagebied, dat meer in lijn is met de Europese schulden crisis. We onderzoeken eerst of de middellange-termijn fluctuaties in het eurogebied inderdaad minder symmetrisch zijn dan korte-termijn fluctuaties. Daarna bekijken we of deze middellange-termijn fluctuaties relevant zijn voor het functioneren van de EMU. Hiervoor kijken we hoe sterk ze

samenhangen met reële oorzaken (als productiviteit) en met financiële oorzaken (kredietverlening en huizenprijzen). Fluctuaties door financiële factoren kunnen leiden tot onevenwichtigheden en crises (Borio, 2012b), en zijn dus schadelijker voor het functioneren van de EMU. We kijken vervolgens of de onevenwichtigheden in prijsconcurrentieposities, lopende rekeningssaldi en begrotingssaldi in de EMU samenhangen met middellange-termijn fluctuaties.

We trekken een aantal conclusies. In het eerste deel van het onderzoek vinden we dat middellange-termijn fluctuaties veel groter en inderdaad veel minder symmetrisch zijn dan korte-termijn fluctuaties. Bovendien zijn middellange-termijn fluctuaties steeds groter en minder symmetrisch geworden, terwijl korte-termijn fluctuaties juist kleiner en symmetrischer zijn geworden. De middellange-termijn fluctuaties in de EMU zijn ook minder symmetrisch dan in de VS, terwijl korte-termijn fluctuaties juist meer symmetrisch zijn. In het tweede deel van het onderzoek vinden we dat de middellange-termijn fluctuaties in het eurogebied sterker zijn gaan samenhangen met financiële variabelen als kredietverlening en huizenprijzen, en minder sterk met reële variabelen als productiviteit. Ook zijn middellange-termijn fluctuaties sterker gerelateerd aan onevenwichtigheden in prijsconcurrentieposities, lopende rekeningssaldi en begrotingstekorten dan korte-termijn fluctuaties. Het middellange-termijn perspectief is relevant geworden door het toegenomen belang van financiële factoren. Het leidt tot een minder positief oordeel over het functioneren van de EMU als optimaal valutagebied en over het idee dat de EMU endogeen een optimaal valutagebied wordt.

Hoofdstuk 4 onderzoekt de stijging van rentes op staatsobligaties tijdens de Europese schulden crisis. Dit onderwerp is controversieel, omdat er geen consensus is over de aard van deze turbulentie op de Europese obligatiemarkten. Sommigen zien de hogere rentes als een rationele marktreactie op toegenomen insolventierisico's door de verslechterde macro-economische fundamenteen, zoals opgelopen staatsschulden (Issing, 2009). In deze visie

zou financiële steun via faciliteiten als het Europese Stabiliteitsmechanisme (ESM), de ECB interventies van het OMT of "veilige activa's als eurobonds" gepaard gaan met grote financiële risico's. Die steun zorgt ook voor moreel risico omdat de disciplinerende werking van financiële markten afneemt (Benink en Huizinga, 2013). Anderen vinden juist dat de hogere rentes komen doordat financiële markten doorschieten, en rentes door overmatige risico-aversie afdrijven van hun fundamentele waarde (De Grauwe en Ji, 2013a). In deze visie is financiële steun wel gerechtvaardigd, omdat liquiditeitsproblemen van overheden anders via zichzelf versterkende verwachtingen leiden tot solvabiliteitsproblemen (De Grauwe, 2012a). Het is dus van groot belang om te weten in welke mate rentes op staatsobligaties in het eurogebied afwijken van hun fundamentele waarde. Dit bepaalt in hoeverre beleidsmakers kunnen vertrouwen op marktdiscipline en in hoeverre financiële steun nodig is.

Dit hoofdstuk onderzoekt daarom in welke mate de rentes op staatsobligaties in EMU-landen tijdens de schuldencrisis verklaard kunnen worden door economische fundamenteën. Hierbij gaan we uit van de inherente onzekerheid die modellen voor obligatierendementen kenmerkt. We schatten verschillende modellen voor obligatierendes, met als verklarende variabelen marktvolatiliteit, marktliquiditeit en macro-economische fundamenteën als groei en overheidsschuld. De centrale vraag is of obligaties redelijke geprijsd zijn ten opzichte van hun fundamenteën en de condities in de markt. Over- of onderwaardering treedt op als de werkelijke rendement buiten het betrouwbaarheidsinterval van het model ligt.

Onze belangrijkste conclusie is dat obligatierendes inderdaad soms fluctuaties kunnen vertonen die niet verklaard worden door macro-economische fundamenteën. Er is dus in zekere mate sprake van over- en onderwaardering en van doorschietende financiële markten. Tegelijkertijd waarschuwt onze benadering anders dan veel andere literatuur tegen het trekken van te sterke conclusies. Via het schatten van verschillende specificaties laten we zien dat de uitkomsten sterk worden beïnvloed

door modelkeuzes. Die keuzes liggen vooral op het gebied rond i) de betrouwbaarheidsintervallen voor de modelvoorspellingen, ii) de vraag of de coëfficiënten gelijk moeten zijn tussen landen, iii) de gebruikte sample, iv) het al dan niet opnemen van financiële variabelen, en v) de mate waarin coëfficiënten in de tijd kunnen variëren. Deze keuzes beïnvloeden de verklaarcracht van macro-economische fundamenteën en de mate van over- of onderwaardering die we vinden. De precieze mate waarin obligatierentes afwijken is dus onzeker, en moet daarom voorzichtig worden geïnterpreteerd.

Hoofdstuk 5 past de bovenstaande bevindingen en bredere inzichten toe op de discussies over de institutionele opzet van de monetaire unie. We beschrijven de literatuur sinds de start van de eurocrisis in 2010 en analyseren de hervormingen in de opzet van de EMU die tot nu toe zijn doorgevoerd. We beschrijven eerst de zwakheden in de oorspronkelijke opzet van de EMU. Die zijn naar voren gekomen tegen de achtergrond van een sterke toename van financiële integratie en financiële onevenwichtigheden sinds het Verdrag van Maastricht. De belangrijkste zwakheden waren: i) een gebrek aan begrotingsdiscipline, ii) onvoldoende aandacht voor uiteenlopende financiële cycli en prijsconcurrentieposities, iii) een gebrek aan financiële steuninstrumenten om crises te beteugelen, en iv) een sterke negatieve wisselwerking tussen banken en overheden in lidstaten.

Dan beschrijven we hoe Europese beleidsmakers al deze zwakheden op de één of andere manier hebben aangepakt. In korte tijd introduceerden lidstaten een herzien Stabiliteits- en Groeipact (SGP), een nieuwe Macro-Economische Onevenwichtigheden Procedure (MEOP), een Europese Stabiliteitsmechanisme (ESM) en Europese mechanismen voor banktoezicht (SSM) en resolutie (SRM). Deze hervormingen zijn van groot belang, maar hun effectiviteit hangt sterk af van strenge handhaving, en die is niet gegarandeerd. Er dreigt dan een onbalans tussen aansprakelijkheid (risicodeling) en zeggenschap (gebrekkige coördinatie). Om deze onbalans te verbeteren zijn twee richtingen denkbaar: ófwel een monetaire unie met meer (expli-

ciete) risicodeling en meer overdracht van soevereiniteit, ófwel een unie die gebaseerd blijft op marktdiscipline en verantwoordelijkheid voor de eigen overheidsschuld. Dan kan de no-bailout clause worden versterkt via een mechanisme voor schuldhierstructurering. Beide zijn pas (politiek) haalbaar als kwetsbaarheden als hoge publiek schulden verder worden aangepakt.

Concluderend laat dit proefschrift zien dat financiële factoren een cruciale rol hebben gespeeld bij verschillende controversiële aspecten rond het functioneren van de EMU. Dit zijn onder andere de ontwikkeling van onevenwichtigheden op de betalingsbalans, de asymmetrie van fluctuaties en de forse stijging van rentes op staatsobligaties tijdens de schulden crisis. Het rekening houden met financiële factoren leidt tot een beter begrip van deze aspecten en bovendien tot andere beleidsaanbevelingen. Onze resultaten pleiten bijvoorbeeld voor meer nadruk op macro-prudentieel beleid om onevenwichtigheden op de betalingsbalans in de toekomst te voorkomen. Onze resultaten suggereren ook dat financiële factoren tot veel grotere en meer langdurige groeiverschillen binnen de muntunie leiden dan vaak wordt aangenomen. Dit vraagt om een duidelijker middellange-termijn perspectief in macro-prudentiële, monetaire en budgettaire beleidsraamwerken. Ten slotte laten onze resultaten zien dat financiële steunmechanismen zoals het ESM of het OMT van de ECB noodzakelijk zijn om de financiële stabiliteit te waarborgen. Hoewel verschillende van deze beleidsaanbevelingen inmiddels zijn doorgevoerd, blijft de discussie over verdere versterking van de EMU door gaan.