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Mag. rer. soc. oec. Mag. phil. Wolfgang Schwarzbauer

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Introduction

The introduction of the euro represented a major change in the monetary policy regime of several European economies in the last decade. Such a change induces changes in agents' behaviour. A natural question in this context is whether the common monetary policy has identical effects in the euro area (EA) member economies once established and if not to what extent is it different. Furthermore can we observe a convergence towards identical effects? Due to differences in financial structures of these economies that persisted in the first decade of the euro there is reason to believe that the monetary transmission has not been homogeneous in EA member economies.

In the literature several channels along which monetary policy affects the real economy have been identified. The *interest rate channel* is the traditional channel of monetary transmission. This channel can be traced back to traditional Keynesian analysis but it is still a central mechanism in modern macroeconomic models about monetary policy¹. A rise in the money supply will lead to a fall in the real interest rate. As a consequence the user cost of capital falls, which induces enterprises to increase their investment spending and thereby raises aggregate demand, leading to an increase in aggregate output. It is however important to stress that the user cost of capital is in real terms, whereas the interest rate under control of the monetary authority is nominal. Therefore we must assume some form of price or wage rigidity to relate nominal interest rates to the user cost of capital. (compare Mishkin 1996)

As was pointed out by Bernanke & Gertler (1995) the effects of an interest rate change by the monetary authority can be larger than the interest rate elasticities of consumption and investment and therefore some researchers hold the view that this story is too simple. This strand of the literature assigns credit markets an important role in the monetary transmission mechanism.

The so-called *credit channel of monetary policy* is due to the imperfect information between lenders and borrowers, which leads to credit frictions. As a consequence there is a gap between the opportunity cost of using internally generated funds and externally obtainable funds for investment, the external finance premium. Proponents of the credit view argue that monetary policy will influence the external finance premium in two ways, through the *balance sheet* of firms and *bank lending*. (Bernanke & Gertler 1995)

The idea of the *balance sheet channel* is that a tightening of monetary policy will affect the borrowers' financial position (net worth), which is the sum of liquid assets and collateral. (compare for instance Bernanke & Gertler 1989) The stronger a borrower's financial position,

¹Compare for instance Rotemberg & Woodford (1997).

the smaller the potential conflicts of interest with the lender, the smaller the external finance premium. Fluctuations in financial wealth will thus affect firms' spending and investment decisions. Monetary policy can affect the financial position in 3 ways. A direct effect will be that due to the outstanding debt the borrower has, an increase in interest rates will raise interest expenditure. Secondly, as rising interest rates are normally associated with declining asset values, the borrowers' balance sheets will be weakened. A more indirect effect is that increases in interest rates will induce the customers of a borrower to decrease their spending, which will depress the firms' revenues and thus over time will decrease borrowers' net worth and probably creditworthiness. (Bernanke & Gertler 1995)

The *bank lending channel* focuses on the role of banks in the transmission of monetary policy. (e.g. Bernanke & Blinder 1988) This channel recognizes banks as the dominant source of external finance. If the central bank increases its policy interest rate, increases in the costs of funds for banks will lead to a decrease of the volume of credit supplied to the economy and therefore raise interest rates at which firms can obtain credit. By how much the lending rate increases will depend on several factors, namely competition in the banking system, considerations about how much an increase in interest rates increases the risk of default of banks' borrowers as well as bank behaviour in general.

Considering the lifetime earnings of households, the corresponding life-cycle model by Ando & Modigliani (1963) offers the notion of another transmission channel that stresses the interrelation of interest rates and asset prices, the so-called *wealth channel*. A decrease in the key interest rate of the monetary authority increases the opportunity costs of stocks, bonds and other assets, thus increasing the households' wealth and inducing a rise of aggregate demand. The precise magnitude of the effect depends on the importance of capital markets and intermediaries.

As most EMU member economies are relatively small the *exchange rate channel*² of monetary transmission is yet another important channel in the European context. Consider an unanticipated decrease in the domestic interest rate. This shock leads to an increase in output and consumption. If the economy is relatively large the world interest rate falls and the nominal depreciation leads to a decline in the domestic country's terms of trade. This will induce foreigners to increase their consumption and therefore the domestic current account will move into surplus. As a result the domestic country will improve in the allocation of net foreign assets. In the long run the domestic country's trade balance will be negative, as the positive growth in net foreign assets will serve to finance the consumption of domestic residents who will consume more than is produced domestically. (compare Lane 2001) If the economy is relatively small the world interest rate will remain unchanged, which means that the decrease in the domestic price level will lead to a capital outflow until the domestic interest rate is back to where it started from. The volatility of nominal exchange rates is of considerable importance in this context for the evolution of real variables such as production and consumption as the domestic price level is linked to the nominal exchange rate. Therefore a change in the nominal exchange rate will change the relative price of domestic versus foreign goods. Bearing this in mind it might be worth considering to eliminate the exchange rate as a source

²see Obstfeld & Rogoff (1995) for a discussion

of distortion either by fixing it to the most important trading partner (as Austria, Belgium, the Netherlands and Denmark did with their respective currencies to the German currency between the 1970s and the 1990s) or joining a monetary union such as the EMU. Eliminating costs arising from exchange rate volatility by fixing the exchange rates (or joining a monetary union) might therefore be beneficial in a welfare economic sense. Engel & Rogers (2001) have however demonstrated that costs associated with joining a monetary union might be as high as costs stemming from floating exchange rates, as this involves changing the monetary policy regime.

The *financial structure* of an economy is the mixture of financial markets and intermediaries operating in the economy. Depending on the design of the financial structure, the different channels of the monetary transmission mechanism will be stronger or weaker.

The basic problem in finance is that investment decisions are made by managers whereas finance is provided by different persons, the investors, who face the problem of delegating the investment decision. A financial intermediary provides the way to deal with the problem of asymmetric information between investors and managers in that she provides the means to monitor the manager on behalf of the investors. This will work in most cases when all parties share the belief that the project to be financed is indeed profitable and so desirable to be undertaken. (Diamond 1984) If this is not the case, which is often the case for new technologies, then markets may be better suited to channel finance from investors to managers. (Allen & Gale 2000)

One way to classify economies with respect to financial structure is to look at the degree of bank dominance in credit markets. In a *bank-based* financial system banks provide substantial parts of funds to finance companies' and households' consumption and investment. As a consequence banks will also heavily influence primary and secondary markets, i.e. share and bond markets. It is therefore clear that the external finance premium, which has to be paid to obtain external funds on the market, will be larger than that to obtain funds via a bank loan. In *market-based* economies on the other hand the main source of funds for consumption and investment is the capital market. Banks and other financial intermediaries play a rather subordinate role. As the market plays the major role, the gap between external finance premia of bank and market financing activities will be smaller than in bank-based systems.

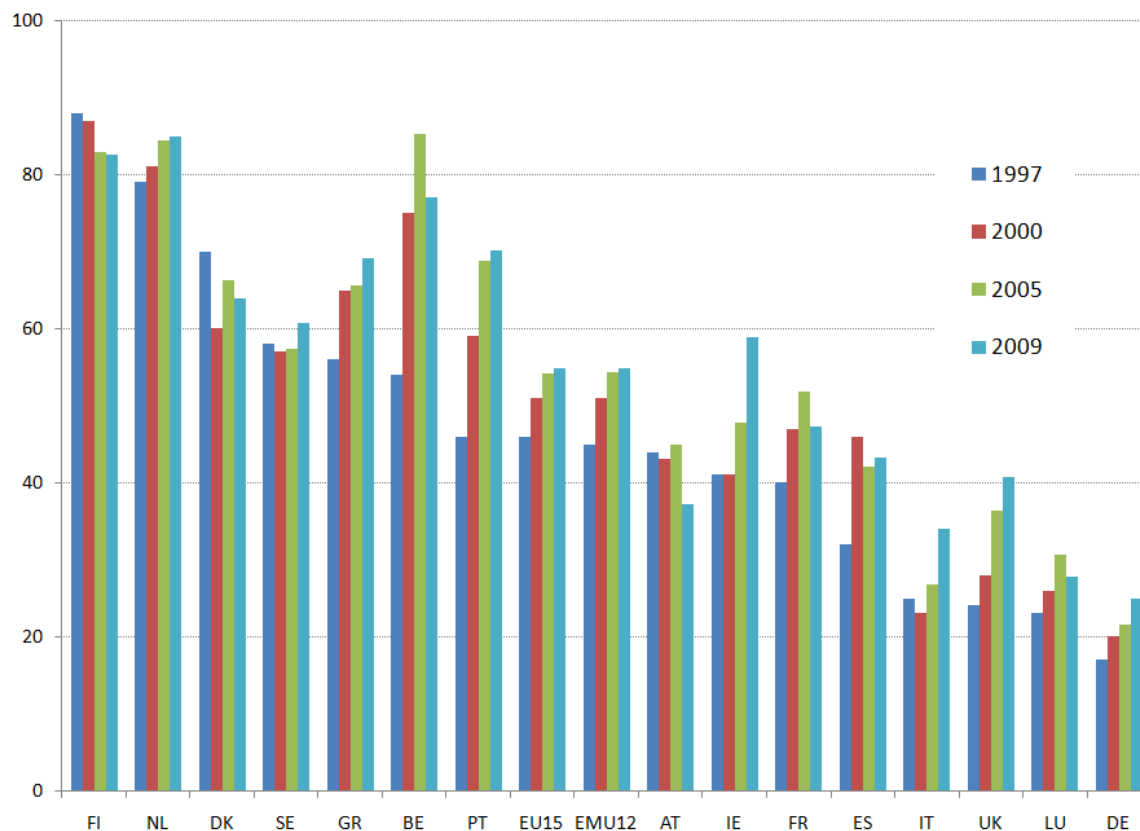
Even though the bank versus market based approach might have some appeal it is probably not the best way to describe a financial system by these relationships, as the relationships themselves might be subject to change over time. A more recent approach focuses much more on the behaviour of economic agents and is the so called Arm's Length versus Relationship-based approach.

Relationship-based and Arm's length refer to two extremes in the spectrum of financing investment and consumption. A *relationship-based* system is close to what was above described a bank-based system, where a financial intermediary acquires some informational advantage over the market by establishing a relationship to the debtor. Attaining a dominant position over the debtor, the lender (e.g. a banking institution) can establish some kind of power over the debtor. This is motivated by her desire to make sure of receiving the expected return from the credit. The necessary condition for this form of relationship is the presence

of market entry barriers. These create a monopolistic credit market regime, which induces welfare losses. (compare Rajan & Zingales 2003) *Arm's length finance* on the other hand enables the borrower to set up relationship to multiple lenders, as there is more information available to each individual lender. This form of financial system usually occurs in deep financial markets with low barriers to entry. As there is more transparency, problems related to asymmetric information will exist only to a minor extent. Thus, borrowers have more incentives to publish information and market prices and interest rates will reflect this information. (Rajan & Zingales 2003) The presence of less informational asymmetry will therefore reduce the benefits of monitoring by financial intermediaries.

Financial structures of European economies have changed considerably over the last 15 years, which is to a large part driven by initiatives related to the establishment of the common currency. Enhanced financial integration could already be observed in the second half of the 1990s. Hartmann, Maddaloni & Manganelli (2003) indicate that prior to the introduction of the common currency, corporations wishing to issue debt in another European country had to consult an investment bank with experience in that respective country. After the introduction they claim that investment banking became increasingly contestable with the result that underwriting fees declined considerably toward that in the US corporate bond market and was almost halved. Government bond markets declined in importance as a result of the stability and growth pact. By eliminating exchange rate risk along with a higher degree of homogeneity the euro further increased the substitutability of government debt and intensified the competition in this market. However government bond markets appear to a certain extent less integrated than that for corporates. Around 2000 government bond yields in the euro area had converged and spreads of yields vis-a-vis German bonds stayed close to zero until 2008 when, as a consequence of the economic and financial crisis, spreads started to rise again. In equity markets, Fratzscher (2002) argued that stock market movements had synchronised in the late 1990s and European equity markets have increased in importance globally. The reduced exchange rate risk and convergent interest rates were the main explanations for this increase in financial market integration.

Banking is of great importance especially in the European economies. Since the early 1990s until 2001 however only a few cross-country mergers could be observed (compare Schmidt 2001) so that the owners of European banks remained national in most cases. Furthermore in most economies country-specific banking structures, such as loan cooperatives and savings banks in some EMU economies like France, Germany, Austria and Finland, were preserved (compare Ehrmann, Gambacorta, Sevestre & Worms 2003) until 2003 displaying no tendency to a higher degree of homogeneity. For most EMU economies a trend towards more concentration could be observed, with a relatively large variation in market shares of the largest banking institutions in individual member countries, as figure 1 displays. In Luxembourg and Germany we could observe a share of the five largest banks in total assets of all banks of around 20 %, whereas in Finland and the Netherlands a share of around 80 % could be observed. It should be noted, that the share of the x largest banks is not a good measure of the degree of competition in the banking market, as it ignores the threat of new entrants. It is quite likely that entry barriers were essentially reduced in the 1990s due to



Sources: ECB (2004), ECB (2010), own illustration.

Figure 1: Share of five largest credit institutes in total assets of all banks, selected years

European legislation and that the number of potential competitors in the banking markets of the single member states increased. Looking at other indicators, there is evidence that competition in EA banking increased. Cross-border interbank lending activity has increased considerably since the introduction of the common currency. Also cross-border retail lending activity has increased, it is however still at a low level compared to interbank lending. (compare OECD 2009)

What are general effects of financial structures on the transmission of monetary policy? This dissertation tries to provide an answer to this question. The first article in chapter 1 compares the transmission of the common monetary policy to the real economy in selected EA economies in the first decade of the euro. As in general agents' response to shocks will have changed we also study reactions in these economies to exogenous inflation and output shocks.

An increase in competition in the EA banking sector due to the introduction of a common currency will certainly have an impact on the degree to which monetary impulses are passed on to companies and individuals. Therefore we would expect to see different speeds of interest rate pass-through before and after the establishment of the common currency inside, but not outside the EA. This lies at the centre of attention of the second article in chapter 2.

In relationship - based financial structures informational asymmetries are likely to be less pronounced than in arms's-length systems. As Gertler & Gilchrist (1993) argue the credit channel is very important for companies with no alternatives to bank credits as a source of external funds. The deeper a stock or bond market is, the more firms will have access to it, and thereby the less firms will depend on bank credits only as a source of (external) funds. Therefore due to the increase in integration of EA financial markets we would expect that more companies in EMU member countries have access to different sources of funds which might decrease the importance of banks in credit markets. As a consequence the transmission of common monetary policy impulses could have become more homogeneous in credit markets. Furthermore the wealth channel and its importance might vary as well in different financial systems. In the last ten years for instance households' asset holdings became increasingly diversified, in most economies of the EA, household wealth in bank deposits declined but still remains at levels above those observed in the US or the UK. The notable exception are Austria and Greece, where bank deposits still represent more than 50% of total assets.(see OECD 2009) As monetary policy affects assets held in banks (such as deposits), shares of companies and debt certificates of governments and companies differently, these differences in the composition of household wealth will affect consumption and investment decisions differently in EMU economies. In a relationship-based economy fewer assets will be traded in the capital market and subsequently, due to the higher monopoly power of banks, returns on these assets will be lower, as well as the liquidity in the market. Thus, the better access of firms to deeper (European) financial markets will change firms' decisions how they finance their investments. The last paper in chapter 3 studies credit markets in small EMU members in the first decade of the euro. Focusing on small EMU members has the benefit that we do not have to account additionally for structural changes in the EA monetary transmission mechanism, as every single small EA member will only have a negligible impact on the EA as a whole. Instead, we can focus on deviations from the EA as a whole. This paper presents a framework to disentangle credit supply and credit demand effects taking the financial structure of these economies into account.

Chapter 1

Same policy, different effects? Evidence on the output effects of monetary policy on selected EA countries after the introduction of the euro

1.1 Introduction

The financial and economic crisis in the last two years hit the European economies differently. Whereas France and Italy has not been affected severely, Germany has been hit more strongly by the global downturn in trade, Ireland and Spain moreover have been affected by the bursting of their real estate market bubbles. Against this background the European central bank had to react to a weighted average development of the euro area, as it is not allowed to react to developments in single member states by its statutes. As a reaction to the global economic and financial crisis it took extraordinary measures to battle the effects of the global downturn on the euro area. The question is whether this single same measure for all economies affected them in the same way or not.

Before the start of phase 3 of EMU in 1999 the effects of monetary policy in the EA member states had been subject to discussion. Some authors emphasized the potential asymmetric nature of the future monetary policy effects (BIS (1994), Locarno, Morgan, Van Els & Villetelle (2001), Cechetti (1999), Mihov & Scott (2001)), while others emphasized that the evidence would be against asymmetric effects (compare Mojon & Peersman (2001), Ciccarelli & Rebucci (2002) and Clausen & Hayo (2002)). All these approaches share a common feature in estimating individual country models with pre-euro data. Therefore these models measure relationships between macroeconomic variables that were determined in a monetary policy regime different to that of the ECB. Even though it has been argued that ECB monetary policy closely resembles that of the Bundesbank before, it can be argued that for some of the

original EA-11 members, like Italy and Spain, the start of phase 3 of EMU meant some serious policy regime shift, which had an impact on the behaviour of agents in all economies. This means that reactions to and of monetary policy observed prior to the euro will have changed after the introduction of the euro, thus these prior studies will be of limited significance. So far no follow up of these studies have been published considering the euro period data only.

This article studies the effects exogenous and endogenous shocks in the euro area as a whole and compares them to the effects in selected euro area countries after the introduction of the euro. This reflects the view, that not only the reaction of macroeconomic aggregates to monetary policy has potentially changed but also the response to exogenous shocks such as commodity price shocks and global demand shocks as well as domestic shocks. Domestic shocks still remain an important source of fluctuations since fiscal policy is conducted on the national level and will affect the euro area aggregate depending on the weight of the respective economy for the euro area. Furthermore due to the elimination of exchange rate risk, euro area wide developments have become more important for the individual euro area countries. This especially applies to small members of the common currency area, but also to the bigger economies such as Germany, France and Italy. It should therefore be distinguished between asymmetries in the euro area that arise from asymmetric effects of the common monetary policy and asymmetric reactions to common macroeconomic shocks.

This article is organized as follows: Section 1.2 discusses three major impacts of establishing the EMU on the effects of monetary policy in its member states. Section 3.4 introduces the model, section 3.5 discusses the results, section 1.5 concludes.

1.2 Will the establishment of EMU lead to symmetry effects of monetary policy in its member states?

As already outlined, establishing a monetary union potentially has three major effects on the individual member states, the elimination of exchange rate risk, the integration of financial markets and a change in the monetary policy regime.

The elimination of exchange rate risk should reduce trade costs between the members of the monetary union. As costs of trade decrease, trade itself will be fostered leading to an intensified integration of markets as already pointed out by Rose (2000) and Rose (2001), which might lead to a harmonisation in the common currency area business cycle. This substantial increase in trade, as originally postulated in Rose's (2000) article is due to the idea that firms increase their exports to other member states and/or the number of exporting firms themselves increases. In subsequent studies this effect was found to be lower than originally argued by Rose (2000), but still large. (compare for an overview De Grauwe & Mongelli 2005) It is however also not clear whether we should observe more synchronous business cycle movements. Eickmeier & Breitung (2006) for example observe for some peripheral EA member states (Greece and Portugal) a lower business cycle correlation than for the EA core and new EU member states which are not EA members for output and inflation. Their analysis also suggests that output and inflation linkages have not changed between member states in the

initial five years after the adoption of the euro. Euro area-wide movements seem to explain movements in inflation and output in the individual member states to varying degrees.

Financial integration is yet another important area where the common currency has a considerable effect. Prior to the launch of the common currency restrictions for cross-border transactions and holdings were gradually eliminated and a single payment system was established to foster the euro-area wide provision of financial services and to enhance competition in financial services. There is evidence that European financial markets have become more integrated before, during and after the introduction of the common currency (compare Adjaoute & Danthine (2003)). Four years after the introduction of the euro, Hartmann et al. (2003) detected evidence for considerable integration in euro area government bond markets and the money markets. Also corporate bonds markets seemed to have integrated, with foreign competition setting in and underwriting fees declining. Regarding equity markets, already in the first years of the euro mergers and consolidation of the national stock markets gained momentum, continuing developments observed by Fratzscher (2002), who found evidence for integration in euro area equity markets already before the launch of the common currency. According to the euro area report of the OECD in 2009, integration in the wholesale banking sector has increased considerably in EA countries, whereas cross-border lending activity in retail banking is however still low. (OECD 2009)

Apart from exchange rate risk and financial integration the third reason why the effects of monetary policy might have changed is due to the fact that the monetary policy regime itself changed. Whereas monetary policy in the EA countries was conducted on a national basis prior to the introduction of the common currency, after 1998 it was conducted by a single monetary policy for the euro area as a whole. Furthermore the policy preferences of the ECB are likely to be different to some central banks in individual member countries previously. Ciccarelli & Rebucci (2006) investigate whether policy reaction functions in the four major economies of the EMU were different prior to the introduction of the common currency and whether they changed over time. The Deutsche Bundesbank is generally considered to be the predecessor of the ECB due to similar policy objectives and targets. Therefore using the Bundesbank as a benchmark Ciccarelli & Rebucci find that the French central bank acted as a follower of Bundesbank policy whereas the Italian and Spanish central banks were less committed to the EMS and also attached a higher weight to the output gap than to inflation. Boivin, Giannoni & Mojon (2008) show that changes in the European transmission mechanism can also be explained by a shift in monetary policy towards a more aggressive response to output and inflation.

Empirical studies on monetary policy transmission in the individual member states of the euro area using data prior to 1999 potentially mismeasure the effects after the introduction of the euro. It is also questionable whether using data prior to the euro will have any relevant information on the issue in the light of the Lucas critique, when the change in the policy regime is not accounted for properly. This study therefore only uses data after the introduction of the euro to assess the impact of monetary policy as well as individual country and aggregate euro area shocks. Aside from the effects of a common monetary policy shock, this paper also considers the effects of a common aggregate demand and price shocks. The euro area could

also be subject to individual country aggregate demand and price shocks as a result of national fiscal policy (such as a change in VA taxes of national stimulus programs). Depending on the economic weight of the respective economy for the euro area aggregate these shocks will have an impact on the monetary union level and therefore affect the decisions of the ECB. If the economy is small the shocks will either be absorbed domestically or are even not important at all as euro area developments will counterbalance these, otherwise these shocks will also have an impact on the other members on the euro area. Thus this article studies the impact of several types of shocks, common euro area shocks, idiosyncratic country shocks and exogenous shocks. We investigate the impact of a common aggregate demand a common price and a common monetary policy shock. Furthermore we investigate the impact of an idiosyncratic aggregate demand and an idiosyncratic price shock.

This article is related to the empirical literature on the transmission of monetary policy in Europe and the US, that builds mainly on data prior to 1998, namely standard SVARs (e.g. Bernanke & Mihov 1998, Bernanke & Mihov 1998, Mihov & Scott 2001, Ehrmann 1998, Mojon & Peersman 2001) to name only a few.

Furthermore we are interested in the transmission of exogenous and euro area wide shocks to individual members of the euro area, which has recently been studied in so-called factor-augmented VAR (FAVAR) models (e.g. Bernanke, Boivin & Elias 2005, Eickmeier 2006, Eickmeier & Breitung 2006, Boivin et al. 2008). This strand of the literature identifies common EA factors and studies their impact on output and inflation in individual countries. In contrast to this literature this paper analyses the impact of euro area output and inflation shocks to individual countries' output and inflation directly, because this is main focus of economic policy making of the ECB. In addition the euro area can be hit by idiosyncratic country shocks: at least for the large countries, output and inflationary developments have a non-negligible impact on the euro area aggregate and therefore on the decisions of the ECB. Leaving out the measurable effects and sources of fluctuations therefore is only telling a part of the story, even though it is clear that the ECB draws on a much larger information set in the formulation of its policy, as suggested by the FAVAR literature.

1.3 Estimation and Simulation

The structure of the empirical euro area model is defined by an output equation, an inflation equation and an interest rate equation, similar to the framework in Rudebusch & Svensson (2002). It is augmented by two further equations, an output and an inflation equation, for every EA member country to capture different output and inflation developments for the individual country vis-a-vis the euro area aggregate. Idiosyncratic shocks to output and inflation are allowed to affect the euro area aggregates only for the three major economies of the euro area, Germany, France and Italy and will therefore (at least indirectly) be relevant for decisions at the ECB level.

1.3.1 The model

The euro area is characterised by three equations. The first equation describes the euro area output gap change as a function of past changes of the output gap, past changes in euro area inflation and past interest rate changes, controlling for changes in the US output gap and changes in oil price inflation. Furthermore changes in the euro area output gap will depend on innovations to the output gap and innovations to the output gap of the three major euro area countries (Germany, France and Italy).

$$\begin{aligned} \Delta \tilde{y}_{ea,t} = & b_{ea,1} \nu_{ea,1,t} + b_{4,i} \nu_{i,1,t} + \alpha_{ea,11} \Delta \tilde{y}_{it-1} + \alpha_{ea,12} \Delta \pi_{it-1} + \dots \\ & \dots + \alpha_{ea,13} \Delta i_{t-1} + d_{1,ea} \Delta X_t \end{aligned} \quad (1.1)$$

where Δ is the difference operator (quarter on quarter), $\tilde{y}_{ea,t}$ is the euro area output gap, π_{it-1} is euro area inflation¹, i_{t-1} is a short term money market interest rate, $d_{1,ea}$ is a 3×1 coefficient vector, $X_t = [\iota_t, \tilde{y}_{us,t}, \pi_{o,t}]$ is a matrix containing a constant, the US output gap ($\tilde{y}_{us,t}$) and annual oil price inflation ($\pi_{o,t}$), $\nu_{ea,1,t}$ is an innovation to the output gap of the euro area and $\nu_{i,1,t}$ is an innovation to a euro area members' output gap.

Changes in euro area inflation are explained by past changes in the output gap of the euro area, past changes in inflation and past changes to the interest rate, contemporaneous changes in the US output gap and to the oil price inflation, innovations to euro area inflation, innovations to the euro area output gap and innovations to large individual countries' inflation.

$$\begin{aligned} \Delta \pi_{ea,t} = & b_{ea,2} \nu_{ea,1,t} + b_{ea,3} \nu_{ea,2,t} + b_{5,i} \nu_{i,2,t} + \alpha_{ea,21} \Delta \tilde{y}_{ea,t-1} + \dots \\ & \dots + \alpha_{ea,22} \Delta \pi_{ea,t-1} + \alpha_{ea,23} \Delta i_{t-1} + d_{2,ea} \Delta X_t + \end{aligned} \quad (1.2)$$

where all variables and operators are defined as above, $\nu_{ea,2,t}$ are innovations to euro area inflation and $\nu_{i,2,t}$ are large countries' inflation.

Finally the interest rule of the ECB is given by

$$\begin{aligned} \Delta i_t = & b_{ecb,1} \nu_{ea,1,t} + b_{ecb,2} \nu_{ea,2,t} + b_{ecb,3} \nu_{ecb,t} + \alpha_{ecb,1} \Delta \tilde{y}_{ea,t-1} + \dots \\ & \dots + \alpha_{ecb,2} \Delta \pi_{ea,t-1} + \alpha_{ecb,3} \Delta i_{t-1} + d_{ecb} \Delta X_t \end{aligned} \quad (1.3)$$

where $\nu_{ecb,t}$ is an unexpected idiosyncratic shock to the interest rate. This monetary policy rule differs from that found in the literature as neither the contemporaneous output gap nor the inflation rate of the euro area enters simultaneously, but shocks to these variables. As we have a difference equation this should be sufficient since the ECB will likely react to shocks that change the output gap and inflation.

¹log-change in the HCPI with respect to the same quarter last year

In matrix notation the submodel for the euro area is given by

$$\begin{pmatrix} \Delta \tilde{y}_{ea,t} \\ \Delta \pi_{ea,t} \\ \Delta i_t \end{pmatrix} = A_{ea}(L) \begin{pmatrix} \Delta \tilde{y}_{ea,t} \\ \Delta \pi_{ea,t} \\ \Delta i_t \end{pmatrix} + \begin{bmatrix} b_{ea,1} & 0 & 0 \\ b_{ea,2} & b_{ea,3} & 0 \\ b_{ecb,1} & b_{ecb,2} & b_{ecb,3} \end{bmatrix} \begin{pmatrix} \nu_{ea,1,t} \\ \nu_{ea,2,t} \\ \nu_{ecb,1,t} \end{pmatrix} + D_{ea} \Delta X_t$$

where L is the lag-operator. More compactly this can be written as

$$\Delta y_{ea,t} = c_{ea} + A_{ea}(L) \Delta y_{ea,t} + B_{ea} \nu_{ea,t} + D_{ea} \Delta X_{ea,t} \quad (1.4)$$

Every member state is characterised by two further equations, an output gap equation and an inflation equation. The output equation is specified as follows:

$$\begin{aligned} \Delta \tilde{y}_{i,t} = & b_{1,i} \nu_{1,it} + \alpha_{i,1} \Delta \tilde{y}_{it-1} + \alpha_{i,12} \Delta \pi_{it-1} + \dots \\ & \dots + \alpha_{i,13} \Delta \tilde{y}_{ea,t-1} + \alpha_{i,14} \Delta \pi_{ea,t-1} + \alpha_{i,15} \Delta i_{t-1} + d_{1,i} \Delta X_t \end{aligned} \quad (1.5)$$

where all variables and operators are defined as above, $\tilde{y}_{i,t}$ is the country's output gap, $\pi_{i,t}$ is the country's annual inflation rate, $d_{1,i} = (c_{1,i}, d_{1,1,i}, d_{1,2,i})$ is a 1×3 coefficient vector and $\nu_{i,1,t}$ is an idiosyncratic shock to country i 's output gap.

The country inflation equation is given by

$$\begin{aligned} \Delta \pi_{it} = & b_{i,2} \nu_{1,it} + b_{3,i} \nu_{2,it} + b_{ea,i} \nu_{ea,t} + \alpha_{i,21} \Delta \tilde{y}_{it-1} + \alpha_{i,22} \Delta \pi_{it-1} + \dots \\ & \dots + \alpha_{i,23} \Delta \tilde{y}_{ea,t} + \alpha_{i,24} \Delta \pi_{ea,t} + \alpha_{i,25} \Delta i_{t-1} + d_{2,i} \Delta X_t \end{aligned} \quad (1.6)$$

where all variables are defined as above, $\nu_{i,2,t}$ is an idiosyncratic shock to country i 's inflation rate (change) $d_{2,i} = (c_{2,i}, d_{2,1,i}, d_{2,2,i})$ is a 1×3 coefficient vector and $\nu_{ea,t}$ is an innovation to the euro area output gap.

The country model for every EA member is thus given by

$$\Delta y_{i,t} = A_i(L) \Delta y_{i,t} + B_i \nu_{i,t} + D_i \Delta X_t \quad (1.7)$$

with $y_{i,t} = (\tilde{y}_{i,t}, \pi_{i,t}, \tilde{y}_{ea,t}, \pi_{ea,t}, i_t)'$, $\nu_{i,t} = (\nu_{i,1,t}, \nu_{i,2,t}, \nu_{ea,1,t}, \nu_{ea,2,t}, \nu_{ecb,1,t})'$, X_t as defined above and

$$B_i = \begin{bmatrix} b_{i,1} & 0 & 0 & 0 & 0 \\ b_{i,2} & b_{i,3} & b_{ea,i} & 0 & 0 \\ b_{4,i} & 0 & b_{ea,1} & 0 & 0 \\ 0 & b_{5,i} & b_{ea,2} & b_{ea,3} & 0 \\ 0 & 0 & b_{ecb,1} & b_{ecb,2} & b_{ecb,3} \end{bmatrix}, \quad A_i = \begin{bmatrix} \alpha_{i,11} & \alpha_{i,12} & \alpha_{i,13} & \alpha_{i,14} & \alpha_{i,15} \\ \alpha_{i,21} & \alpha_{i,22} & \alpha_{i,23} & \alpha_{i,24} & \alpha_{i,25} \\ 0 & 0 & \alpha_{ea,11} & \alpha_{ea,12} & \alpha_{ea,13} \\ 0 & 0 & \alpha_{ea,21} & \alpha_{ea,22} & \alpha_{ea,23} \\ 0 & 0 & \alpha_{ecb,1} & \alpha_{ecb,2} & \alpha_{ecb,3} \end{bmatrix}$$

The major difference between small and large EA member countries is that small countries' output and inflation shocks don't affect the EA's output gap and price level respectively, i.e. $b_{4,i} = b_{5,i} = 0$. Note that this system allows output gap and inflation shocks of individual member states to influence ECB decisions even though ECB policy is not allowed to react to

developments in single EA member economies. But in fact a German output gap shock will implicitly influence ECB decisions, as this shock will likely have an impact on the euro area's output gap and inflation.

1.3.2 Specification and estimation

Models (1.4) and (1.7) are estimated and then simulated separately to compare the responses to shocks to the individual variables.

All parameters are estimated using a FGLS (EGLS) procedure. This involves estimating the reduced form of the model first, which is done by OLS. The reduced form of the model is obtained by specifying a relationship between the structural innovations (ν_t) and the errors of the reduced form (ϵ_t) which is for this model given by

$$\epsilon_t = B\nu_t$$

Given the OLS estimates of the system ($\hat{A}(L)$, \hat{D} and \hat{c}) we can obtain an estimate for matrix B , i.e. \hat{B} , which allows us to decompose the reduced form VC-matrix ($\hat{\Sigma}$) of the system ($B\Sigma B'$).

To obtain impulse response functions for the shocks of the system we transform models (1.4) and (1.7) into their structural VMA form,

$$\Delta y_t = c + \sum_{i=0}^{\infty} \Theta_{exo,i} \Delta X_{t-i} + \sum_{i=0}^{\infty} \Theta_i \nu_{t-i}$$

which yields the following impulse response functions

$$\begin{aligned} \Theta_0 &= B, \Theta_1 = A_1 \Theta_0, \Theta_2 = A_1 \Theta_1 + A_2 \Theta_0, \dots \text{ (for shocks to endogenous variables)} \\ \Theta_0 &= B * D, \Theta_1 = A_1 \Theta_0, \Theta_2 = A_1 \Theta_1 + A_2 \Theta_0, \dots \text{ (for exogenous shocks)} \end{aligned}$$

1.4 Results

1.4.1 Data

Data on the output gaps, inflation rates, oil prices at quarterly frequency of all countries were obtained from the economic outlook database of the OECD from 1995:1 - 2009:2. All data are in quarter/quarter level-differences. The interest rates of the ECB on a quarterly frequency were obtained from Eurostat 1999:1 - 2009:2. Interest rates enter the VARs in quarter/quarter differences. Details on the interest rates are shown in the appendix.

Due to data availability² we could only estimate the country model specified in equation

²The OECD publishes quarterly output gaps only for six EA countries, i.e. Germany, France, Italy, Finland, Ireland and the Netherlands. We also tried to estimate country models for all euro area members using HP-filtered series of real GDP, but the results we obtained were mostly counter-intuitive from an economic

(1.7) for a subset of the euro area. The estimation period is 1999:1 - 2008:4, which means we can only work with 40 observations³. We use the AIC criterion to obtain the lag length for each country pair (compare table 1.8) and the interest rule of monetary policy individually.

1.4.2 General Observations

Figure 1.2 displays the results of the EA submodel. The first column of graphs displays the effects of a one s.d. shock to the EA output gap. We find that inflation increases following an unanticipated shock to the EA output gap that also induces the ECB to increase its policy rate. As a consequence the output gap narrows again which, after a lag leads to a decrease in inflation.

The second column of graphs displays the effects of an unanticipated shock to the inflation rate, which leads to a negative output gap. The ECB reluctantly lowers eventually the interest rate as inflationary pressures decrease, which all together boosts aggregate demand leading to a reduction in the output gap, which is finally closed.

The third column displays the effects of an unanticipated increase in the ECB policy rate. This leads to a negative output gap, which drives down inflation. This again boost aggregate demand, which closes the output gap again leading to an increase in inflation again back to the level before the monetary policy shock. Overall we find an response pattern to a monetary shock that is similar to those observed in the literature.

1.4.3 The effects of monetary policy

The last column of graphs in figures 1.2 - 1.8 display the effect of a one sd. increase in the ECB interest rate on the euro area output gap, the individual country output gaps as well as euro area and national inflation rates. In the individual country system plots the effects on output and inflation are displayed in the two first graphs in the last column. Table 1.1 compares the maximal output and inflation effects between the euro area and the six economies.

The output gap in the euro area immediately decreases in the euro area and four of the six economies. We observe similar patterns for most of the economies over time, and also the maximal output gap effect after about 12 quarters. For Germany we observe a significantly higher impact of the interest rate shock compared to the euro area aggregate as well as in comparison to the other economies.

For inflation we observe for Germany, Finland and Ireland an almost immediate decline in inflation. The effects for the euro area are similar to those of Germany and Finland, whereas for Ireland we can observe a stronger effect of an interest rate increase. For France, Italy and the Netherlands we first observe an increase in the rate of inflation, with a gradual decline over the first 20 quarters.

perspective.

³Even though it might be problematic in terms of robustness of results, given the number of parameters we estimated, we hold the view that this exercise is nevertheless interesting. Furthermore, as already mentioned, it is questionable whether including information prior to 1999 would yield more benefits than problems in terms of having to account for the regime shift.

	output gap				inflation			
	low	p.e.	high	quarter	low	p.e.	high	quarter
EA	-0.0089	-0.57	-0.22	12	-0.43	-0.24	-0.03	18
DE	-0.96	-1.17	-2.17	13	-0.23	-0.33	-0.57	14
FR	-0.52	-0.27	-0.27	14	0.13	0.19	0.41	8
IT	-1.07	-0.54	-0.37	12	0.02	0.08	0.18	5
FI	-1.14	-0.39	-0.05	12	-0.76	-0.33	-0.01	10
IRE	0.36	0.56	1.18	2	-1.84	-1.13	-0.87	7
NL	-	-	-	-	0.25	0.33	0.61	4

Notes: one s.d. shock to the interest rate corresponds to an increase of the interest rate of 0.11 (EA: 0.14) percentage points; p.e. = point estimate; high (low) is the upper (lower) bound of the 90 % bootstrapped Hall Confidence Interval; own estimation.

Table 1.1: Maximal effects of a monetary shock, in percentage points

Overall we can also observe that the timing of the maximal effects for four of the six economies in terms of the output gap is very similar to the timing of the euro area. On the other hand the timing of the effects of monetary policy on inflation is different, only Germany displays a comparable pattern to that of the euro area as a whole, probably also reflecting the importance of the German economy for the euro area as a whole.

In a meta-study on the effectiveness of monetary in the euro area and the US, De Grauwe & Costa Storti (2005) find that in the short run the median output effect of monetary policy of 81 studies is about -0.28 % ranging between -0.91 % and 0.61 %. The results of this study indicates a close to the median effect for the euro area, a slightly lower than medium effect for France, Italy and Finland and a considerably large effect for Germany. Also note that the result for Ireland is still within the range of these studies. Regarding inflation they summarise the median short run effect of monetary policy to be around -0.07%, ranging between -0.81% and 0.44%. Our result indicate a stronger effect for the euro area, Germany, Finland and most notably Ireland. The results for France Italy and the Netherlands is still within the range of these previous studies.

1.4.4 Euro area-wide and exogenous Shocks

Euro area-wide shocks

This subsection studies the effects of an euro area output gap shock as well as an euro area inflation shock on output and inflation in the euro area as a whole as well as in its members.

The response of inflation and the ECB interest rate to an euro-area output gap shock is displayed in the first column figure 1.2 in the appendix. The euro area output gap shock fades out after about 10 quarters in the euro area. This results in inflationary pressures which leads to a rise in euro area inflation picking up with some time lag, the maximum effect can be observed after about 12 quarters. As the output gap shock exerts inflationary pressures the ECB reacts accordingly and raises interest rates quickly to halt and reverse inflationary developments.

	output gap				inflation			
	low	p.e.	high	quarter	low	p.e.	high	quarter
EA	0.72	1.04	0.0141	6	0.72	1.03	1.37	12
DE	1.11	1.54	0.029	8	0.17	0.25	0.57	7
FR	0.42	0.5	0.0098	4	1.44	1.67	2.97	14
IT	1.37	1.24	0.0255	6	0.21	0.37	0.84	15
FI	1.37	1.46	0.0216	5	0.43	0.88	1.84	12
IRE	0.78	1.17	0.022	5	-	-	-	-
NL	0.43	0.66	0.0121	6	1.67	2.61	4.37	17

Notes: one s.d. shock to the EA output gap corresponds to an increase of the output gap by 0.29 (EA: 0.35) percentage points; p.e. = point estimate; high (low) is the upper (lower) bound of the 90 % bootstrapped Hall Confidence Interval; own estimation.

Table 1.2: EA Output gap shock

The effects in the individual EA members can be compared in the top two graphs in the middle column of figures 1.3 - 1.8. This euro area-wide output shock leads to an expansion of the output gap of all the member states and inflationary pressures for all euro area members (except Ireland). We can observe - similar to the developments in the euro area - the maximal effect on the output gap after about 5 - 8 quarters. For Germany and Italy we can observe that the effects appear to be larger than for the euro area as a whole, whereas the effects seem to be smaller in the other economies. Inflationary pressures stemming from a euro area demand shock appear to be smaller compared to the whole euro area in case of Germany and Italy, whereas for France and the Netherlands we observe stronger inflation effects.

	output gap				inflation			
	low	p.e.	high	quarter	low	p.e.	high	quarter
EA	-1.195	-1.42	-1.01	13	0.26	0.42	0.53	6
DE	-0.54	-0.17	-0.12	3	-0.34	-0.06	-0.03	1
FR	0.22	0.27	1.23	9	0.12	0.2	0.53	1
IT	-1.63	-0.67	-0.26	10	-	-	-	-
FI	-2.5	-1.55	-1.29	12	0.16	0.31	0.6	5
IRE	-1.64	-0.92	-0.5	6	0.17	0.23	0.4	0
NL	-2.78	-1.61	-1.27	13	0.71	0.99	1.64	8

Notes: one s.d. shock to the EA inflation rate corresponds to an increase of the inflation rate by 0.17-0.19 (EA: 0.22, DE: 0.08, FR: 0.01) percentage points; p.e. = point estimate; high (low) upper is the (lower) bound of the 90 % bootstrapped Hall Confidence Interval; own estimation.

Table 1.3: Euro Area Inflation Shock

The response of the euro area output gap and the ECB interest rate to an euro area inflation shock is displayed in the middle column of figure 1.2 in the appendix. Similar to an euro area-wide output gap shock a euro area-wide inflation shock dies out after about 10 quarters. The euro area output gap starts to decline immediately and starts to rise again after

about 12 quarters. The ECB keeps interest rates unchanged for about six to eight quarters and reacts to the decline in the output gap to stabilise the economy as a whole by lowering interest rates, considering the transitory nature of this shock not being a threat to the overall EA price level in the longer run.

The effects in the individual EA members can be compared in the top two graphs in the fourth column of figures 1.3 - 1.8. For the small EA member countries there are apparently significant inflationary pressures, whereas the large euro area members appear to be only insignificantly affected by the euro area shock. The transmission of the euro area inflation shock to the individual member countries appear instantaneous and also die out quickly. The effect on the members' output gaps seem to occur to be faster in Germany and Ireland than in the remaining euro area countries.

Exogenous shocks

This subsection focuses on the effects of exogenous shocks with special interest in the direct instantaneous impact. The instantaneous response of the endogenous variables of the system depends on two types of coefficient matrices, matrix B specifying the contemporaneous effects of endogenous shocks to the system and matrix D specifying the instantaneous effect of the exogenous disturbances. Given the information above it suffices to check differences in instantaneous coefficient matrices to see whether exogenous shocks will have the same or a different impact on inflation, the output gap in the euro area and its members as well as the reaction of the ECB. Table 1.4 displays the estimated coefficients of the coefficient matrices D .

	output gap		inflation	
	$d_{1,1}$	$d_{1,2}$	$d_{2,1}$	$d_{2,2}$
euro area	0.159 (0.147)	0.003 (0.004)	0.035 (0.092)	0.016*** (0.002)
ecb	0.144** (0.070)	0.001 (0.002)	0.144** (0.070)	0.001 (0.002)
de	0.216 (0.214)	0.005 (0.005)	-0.146 (0.108)	0.015*** (0.003)
fr	0.305** (0.131)	0.002 (0.003)	0.2* (0.113)	0.019*** (0.003)
it	0.121 (0.125)	-0.004 (0.003)	-0.043 (0.079)	0.009*** (0.002)
fi	0.404* (0.231)	0.007 (0.006)	-0.106 (0.124)	0.015*** (0.003)
ire	1.227* (0.667)	0.011 (0.016)	-0.161 (0.141)	0.018*** (0.004)
nl	0.081 (0.167)	0.012*** (0.004)	0.201** (0.101)	0.002 (0.003)

Notes: ***, **, * indicates significant at the 1, 5, 10 % level, standard errors in parentheses; own estimation.

Table 1.4: Exogenous shocks

Interestingly, a shock to annual oil price inflation exerts similar inflationary pressures in the euro area and its member countries (coefficient $d_{2,2}$ in the inflation equations). The ECB reacts significantly to foreign demand shocks (proxied by the US output gap change) significantly, even though it only affects the French, the Finnish and Irish output gap positively and leads to inflationary pressures as a consequence. Finally an increase in oil price inflation positively affects the Dutch output gap positively.

1.4.5 Individual country shocks

This section studies how strong output gap shocks and inflation shocks in individual member countries of the euro area are transmitted to the euro area. This analysis is restricted to the three large EA member economies in this study, Germany, France and Italy, as these are likely to exert some influence on the euro area aggregate due to their economic importance.

As can be seen in the country systems in figures 1.3 - 1.5, the output gap shocks have only a minor and mostly insignificant impact on the euro area aggregate. This is probably either due to their minor importance in the estimation sample period or due to a bad identification. This type of shock will therefore not further be investigated.

The second type of shock, that probably affects the EA as a whole, originating from the larger EA members economies is an inflation shock. This is more interesting as it probably is more likely to occur since administered prices and price regulations are a source of individual member countries' inflation factors, as a lot of policy areas like fiscal policy are still determined on a national level. Table 1.4.5 displays the maximal effects and their timing of country-specific inflation shocks.

		output gap				inflation			
		low	p.e.	high	quarter	low	p.e.	high	quarter
DE	DE	-3.77	-1.64	-1.52	14	0.28	0.26	0.49	0
	EA	-0.99	-0.51	-0.86	14	0.27	0.29	0.65	6
FR	FR	-1.51	-0.85	-0.8	12	0.18	0.18	0.28	0
	EA	-2.05	-1.17	-1.09	13	0.39	0.38	0.64	7
IT	IT	-2.06	-0.82	-0.33	13	0.18	0.17	0.32	0
	EA	-1.96	-0.89	-0.45	14	0.18	0.29	0.66	6

Notes: one s.d. shock to the inflation rate corresponds to an increase of the inflation rate by 0.26 (DE), 0.23 (FR) and 0.17 (IT) percentage points; p.e. = point estimate; high (low) indicates the upper(lower) bound of the 90 % bootstrapped Hall Confidence Interval; own estimation.

Table 1.5: Individual EA member inflation shocks

We can observe that individual inflation shocks also transmit to EA inflation of a similar magnitude for France and Italy, German inflation shocks appear to cause a significantly lower degree of inflation for the EA as a whole. The output effects of French and Italian inflation shocks tend to be slightly stronger for the EA output gaps than for the French and Italian output gaps, for Germany we observe the opposite.

Regarding the timing of inflation stemming from the individual inflationary shocks we can observe that for all individual shocks the maximal inflation effects occur six quarters after the

shock. The resulting negative pressure on the output gap is maximal 12 to 14 quarters after the inflation shock occurs, pointing at a uniform response in terms of the timing.

1.4.6 Contributions of common shock to national output gaps and inflation

An important question is to what extent do inflation and the output gap in the euro area determine output gap and inflation developments in its member states. Therefore we conducted a forecast error variance decomposition of the structural VAR models and compare the results for the individual member states in table 1.6.

For the output gap we obtain that most of the variance can be attributed to the past variance of the series for all economies but Finland, where euro area output gap changes are the most important sources of variation. For the large economies except France domestic inflation and the euro area output gap explain a large part of the variance in output gaps, but the major contributions stem from past variation in the domestic output gap. The euro area interest rate shock contributes to German and Italian output gap variance mostly after about 3 years. For all other economies its contribution is however small.

As we would expect, a larger part of the variance in inflation and the output gap is explained by euro area developments for small economies as opposed to large economies, since the first largely depend more heavily on euro area business cycle developments.

The major component of the variance in inflation in the member states can be attributed to past domestic inflation changes. The second largest component come for the large economies is the domestic output gap developments followed then by euro area developments, where we again observe for France mainly euro area inflation and for Germany and Italy euro area output gap changes as a major euro area component. For the small economies, apart from past domestic inflation fluctuations, the major components of variation in domestic inflation across time is due to euro area output gap and inflation fluctuations.

		$\Delta \tilde{y}_{it}$					$\Delta \pi_{it}$				
		quarter					quarter				
		4	8	12	16	20	4	8	12	16	20
DE	$\Delta \tilde{y}_{it}$	0.89	0.72	0.58	0.61	0.63	0.02	0.29	0.26	0.3	0.39
	$\Delta \pi_{it}$	0.02	0.12	0.14	0.12	0.11	0.57	0.39	0.39	0.35	0.29
	$\Delta \tilde{y}_{it}$ (EA)	0.03	0.03	0.08	0.11	0.09	0.28	0.17	0.17	0.19	0.16
	$\Delta \pi_{it}$ (EA)	0.02	0.03	0.05	0.04	0.04	0.04	0.05	0.05	0.05	0.04
	i_t	0.05	0.11	0.15	0.12	0.13	0.09	0.1	0.12	0.11	0.12
FR	$\Delta \tilde{y}_{it}$	0.63	0.43	0.45	0.47	0.4	0.11	0.23	0.41	0.3	0.35
	$\Delta \pi_{it}$	0.08	0.18	0.17	0.17	0.22	0.58	0.38	0.26	0.31	0.28
	$\Delta \tilde{y}_{it}$ (EA)	0.1	0.08	0.09	0.1	0.08	0.09	0.15	0.12	0.08	0.07
	$\Delta \pi_{it}$ (EA)	0.17	0.28	0.26	0.24	0.26	0.18	0.21	0.18	0.29	0.26
	i_t	0.02	0.03	0.03	0.03	0.03	0.04	0.03	0.02	0.03	0.03
IT	$\Delta \tilde{y}_{it}$	0.74	0.7	0.55	0.57	0.71	0.15	0.26	0.41	0.44	0.38
	$\Delta \pi_{it}$	0.06	0.05	0.07	0.07	0.04	0.71	0.49	0.36	0.29	0.29
	$\Delta \tilde{y}_{it}$ (EA)	0.15	0.08	0.13	0.18	0.12	0.08	0.13	0.09	0.09	0.13
	$\Delta \pi_{it}$ (EA)	0.01	0.01	0.01	0.01	0	0.01	0.02	0.02	0.02	0.01
	i_t	0.04	0.17	0.24	0.17	0.12	0.05	0.11	0.11	0.16	0.18
FI	$\Delta \tilde{y}_{it}$	0.47	0.42	0.32	0.25	0.21	0.13	0.13	0.1	0.08	0.05
	$\Delta \pi_{it}$	0.02	0.02	0.02	0.02	0.01	0.56	0.45	0.35	0.28	0.19
	$\Delta \tilde{y}_{it}$ (EA)	0.46	0.41	0.48	0.59	0.55	0.22	0.34	0.39	0.34	0.49
	$\Delta \pi_{it}$ (EA)	0.02	0.11	0.14	0.12	0.19	0.02	0.02	0.1	0.22	0.2
	i_t	0.03	0.04	0.03	0.03	0.04	0.07	0.06	0.07	0.08	0.06
IRE	$\Delta \tilde{y}_{it}$	0.72	0.7	0.6	0.6	0.61	0.01	0.04	0.05	0.04	0.04
	$\Delta \pi_{it}$	0	0	0	0	0	0.34	0.23	0.18	0.13	0.11
	$\Delta \tilde{y}_{it}$ (EA)	0.13	0.2	0.28	0.28	0.27	0.22	0.15	0.18	0.35	0.45
	$\Delta \pi_{it}$ (EA)	0.02	0.02	0.02	0.03	0.02	0.08	0.2	0.28	0.23	0.21
	i_t	0.13	0.08	0.09	0.09	0.09	0.35	0.37	0.31	0.24	0.2
NL	$\Delta \tilde{y}_{it}$	0.65	0.62	0.59	0.61	0.64	0.16	0.12	0.19	0.32	0.49
	$\Delta \pi_{it}$	0.01	0.01	0	0	0	0.39	0.08	0.07	0.03	0.02
	$\Delta \tilde{y}_{it}$ (EA)	0.11	0.2	0.3	0.33	0.31	0.09	0.64	0.61	0.53	0.39
	$\Delta \pi_{it}$ (EA)	0.17	0.14	0.08	0.04	0.03	0.15	0.1	0.08	0.08	0.07
	i_t	0.06	0.04	0.03	0.02	0.02	0.22	0.05	0.05	0.04	0.04

Source: own estimation.

Table 1.6: Variance of output gap and inflation explained by the variance of other variables

1.5 Summary

We investigated the role of different shocks to the euro area and its members using SVAR techniques for the period after the introduction of the euro. We considered four types of shocks, common output and inflation shocks, monetary policy shocks, oil price and global demand shocks and idiosyncratic inflation shocks to the three largest economies of the EA.

Common output gap shocks in euro area affect most members' output gap and inflation rates in a similar fashion, in terms of timing and maximal effects, with inflation feeding through more slowly. EA-wide inflation shocks appear to be transmitted to small member states more strongly even though the timing is quite different. For the three large economies we observe a rather inhomogeneous picture, as we observe a negative impact on German inflation and no impact on Italian inflation.

For most of the member states in our study we find a relatively homogeneous picture for the output effects of monetary policy in terms of the maximal effects and the timing. Germany appears to be more strongly affected than the euro area aggregate, even though the timing is the same. For the impact of monetary policy on inflation we observe however a rather inhomogeneous picture. For Germany, Ireland and Finland we obtained comparable maximal effects, even though the timing of the maximal impact is quite different. For the other three economies the effect of monetary policy results in an increase in inflation rather than a decline. This is very surprising and counterintuitive.

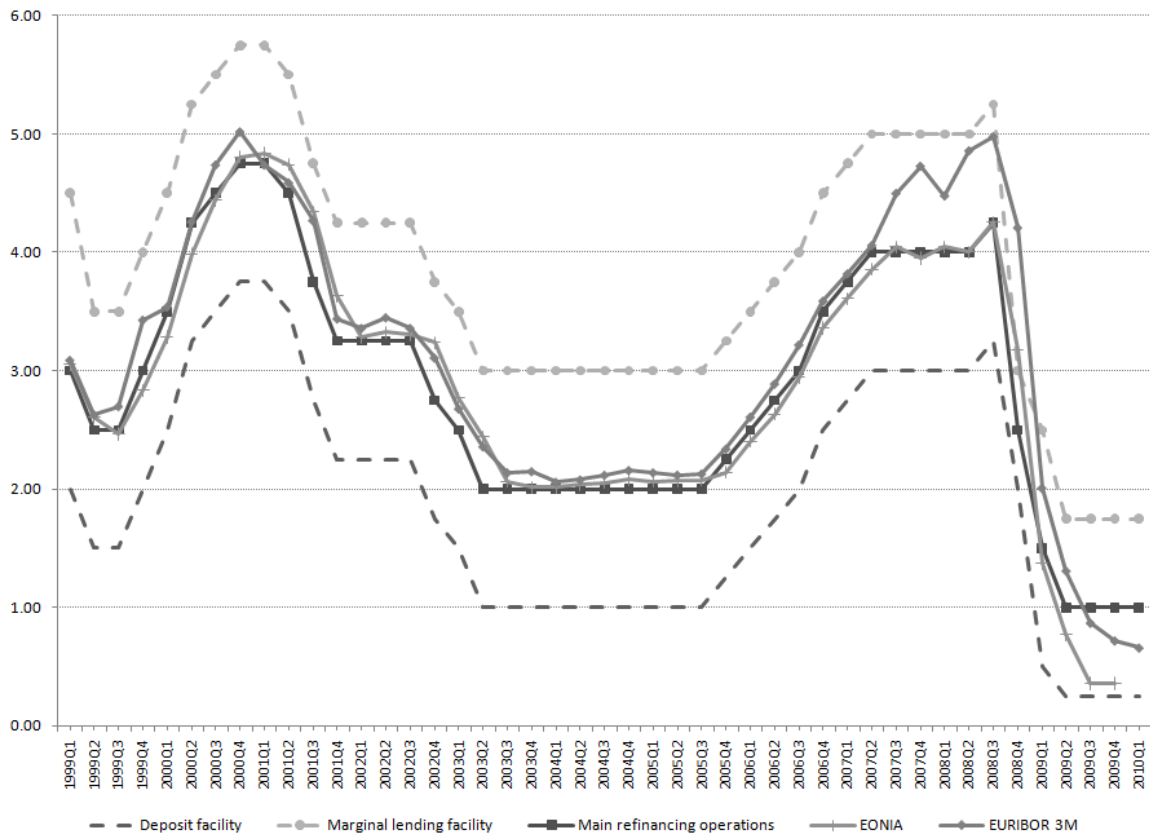
For exogenous shocks to the euro area we find that the instantaneous impact of oil price inflation that is almost the same for the euro area and its members. Furthermore we see that global demand shocks (as proxied by an increase in the US output gap) appear to affect only some countries' output gaps and thus their inflation rates significantly, but the ECB reacts instantaneously to reduce inflationary pressures.

Finally the impact of individual country inflation shocks appear to impact the euro area strongly, but the timing of maximal effects is almost identical for the three large EA members in our sample.

Overall we find that the output effects of monetary policy are relatively homogeneous in the first decade of the euro, inflation effects appear to be different still in terms of timing and maximal impacts. Furthermore there is evidence that inflationary policies in individual member states might have non-negligible impacts on inflation in the euro area as whole and might create problems for the ECB to stabilise inflation and output fluctuations.

Appendix

Summary statistics



Source: ECB, own illustration.

Figure 1.1: ECB and money market key rates 1999:1 - 2010:1

	(1)	(2)	(3)	(4)	(5)
(1) deposit facility	1.00	1.00	0.98	0.97	0.97
(2) main refinancing rate	1.00	1.00	0.99	0.98	0.96
(3) marginal lending rate	0.98	0.99	1.00	0.97	0.95
(4) EONIA	0.97	0.98	0.97	1.00	0.97
(5) EURIBOR 3M	0.97	0.96	0.95	0.97	1.00

Source: own calculations.

Table 1.7: Correlation between key interest rates, euro area, 1999:1 - 2010:1

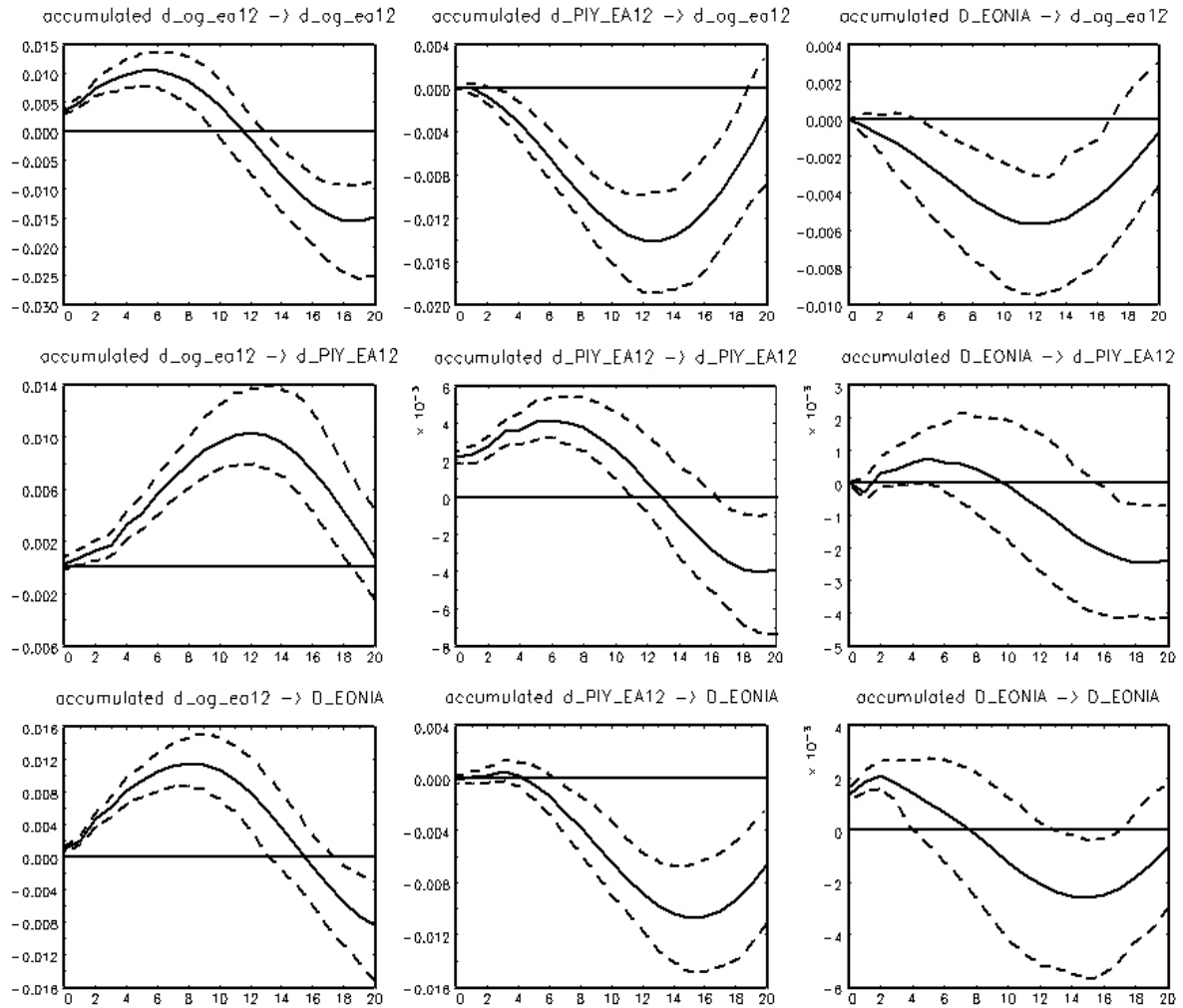
	SIC	AIC	HQ	sample size
euro area	2	3	3	1999:1 - 2008:4
de	1	2	2	1999:1 - 2008:4
fr	1	4	2	1999:1 - 2008:4
it	1	4	2	1999:1 - 2008:4
fi	3	3	3	1999:1 - 2008:4
ire	1	4	4	1999:1 - 2008:4
nl	4	4	4	1999:1 - 2008:4

Source: own estimation.

Table 1.8: Lag selection criteria and sample size

Country systems impulse response functions

Figures 1.2 - 1.8 display the impulse response functions of the EA system and those of the individual countries. The variables of the EA system are ordered in the following way: $y_t = (\tilde{y}_{ea,t}, \pi_{ea,t}, i_t)'$.



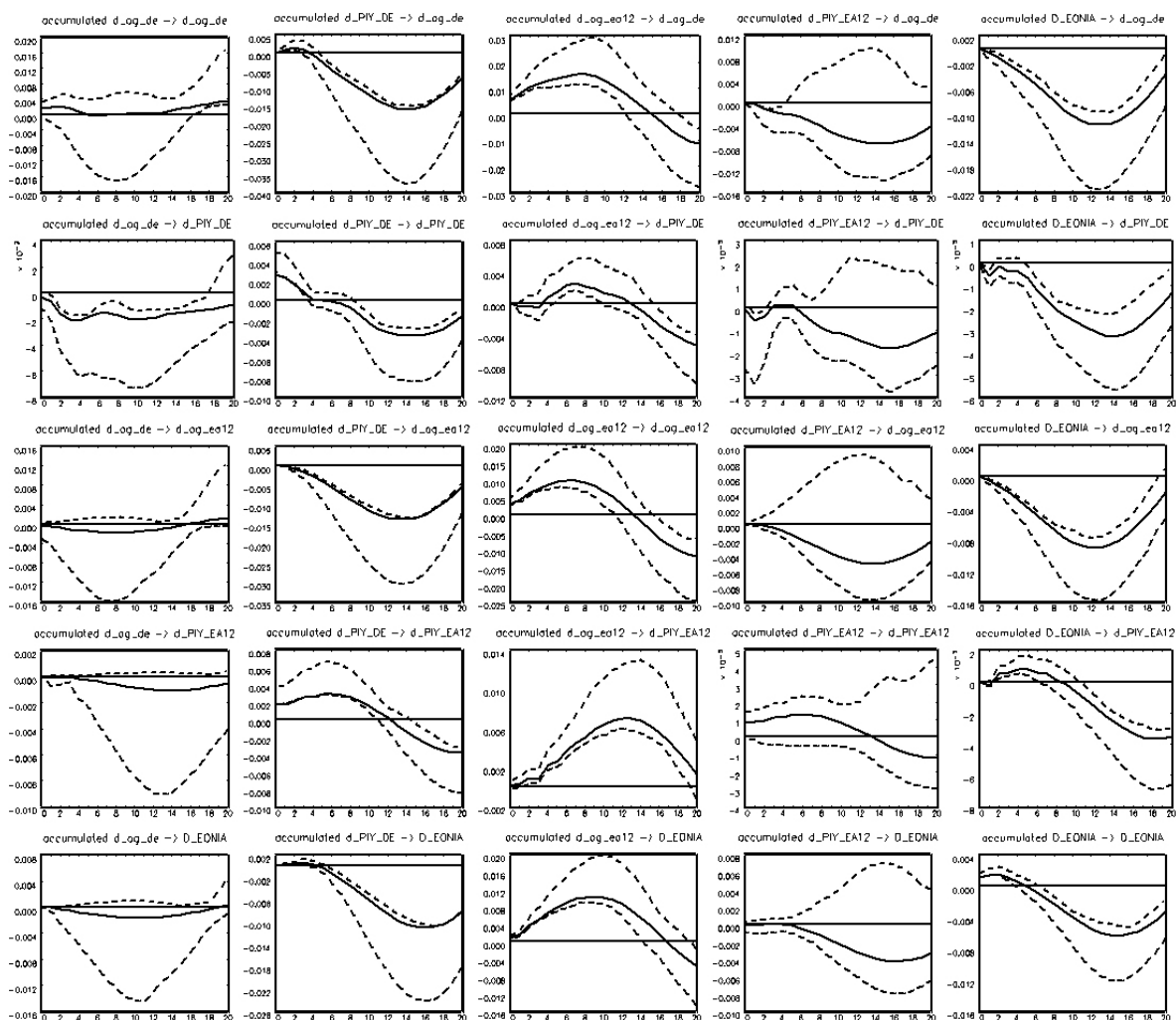
Notes: first column top-down: accumulated response of the EA output gap, inflation and the interest rate to a one s.d. output gap shock; second column top-down: accumulated response of the EA output gap, inflation and the interest rate to a one s.d. inflation shock; third column top-down: accumulated response of the EA output gap, inflation and the interest rate to a one s.d. interest rate shock. Dashed lines are upper and lower bounds of the 95% bootstrapped confidence interval.

Source: own calculations.

Figure 1.2: Euro area System

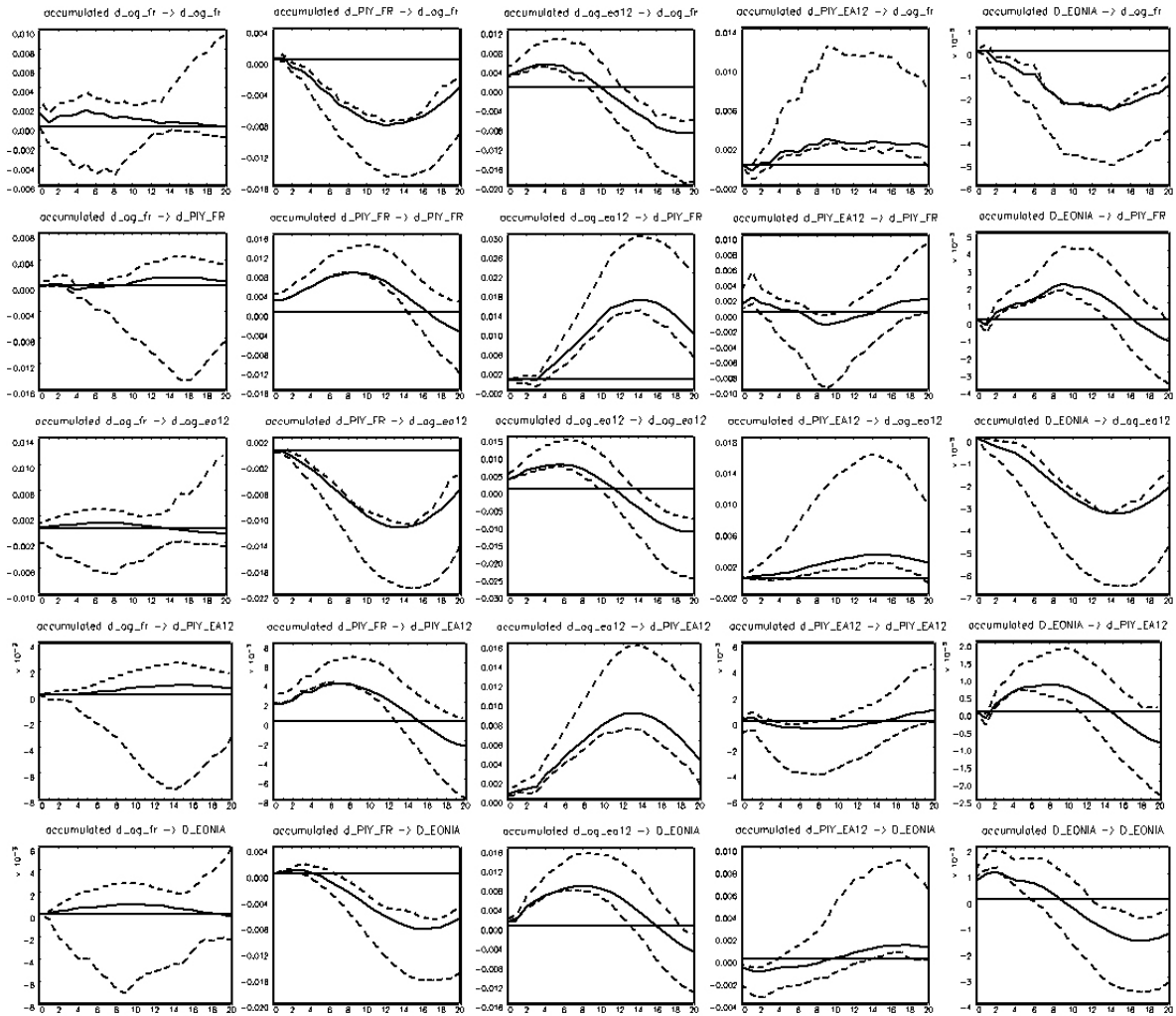
The variables of the country models are ordered in the following way

$$y_t = (\tilde{y}_{i,t}, \pi_{i,t}, \tilde{y}_{eat,t}, \pi_{ea,t}, i_t)'$$



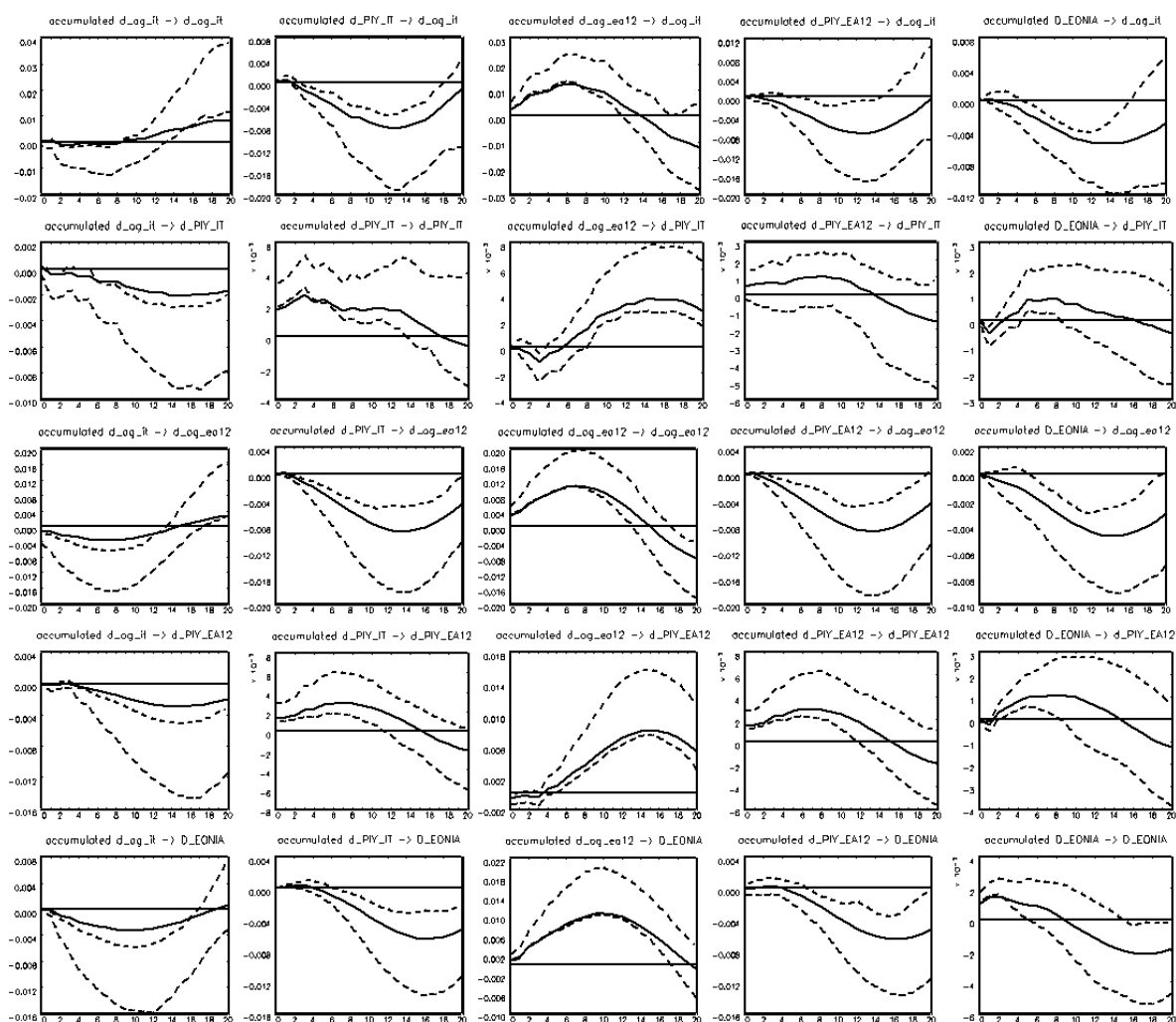
Notes: The first column top-down displays accumulated responses of the country's output gap, the country's inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. country specific output gap shock. The second column top-down displays accumulated responses of the country's output gap, the country's inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. country specific inflation shock. The third column top-down displays accumulated responses of the the country's output gap, the country's inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. EA output gap shock; the fourth column top-down displays accumulated response of the the country's output gap, the country's inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. EA inflation shock; the fifth column top-down displays accumulated response of the the country's output gap, the country's inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. interest rate shock. Dashed lines are upper and lower bounds of the 95% bootstrapped confidence interval. Source: own calculations.

Figure 1.3: German System



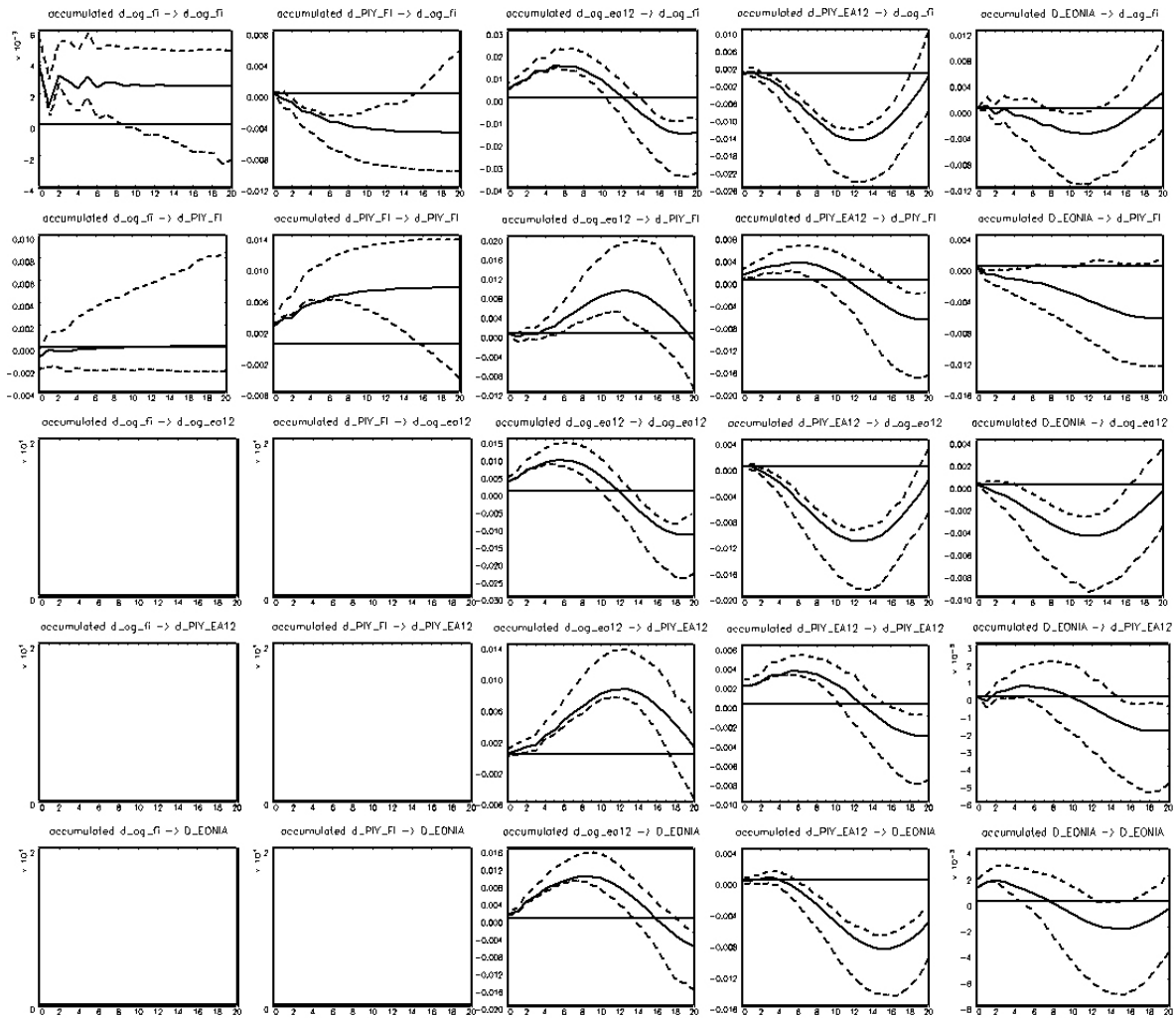
Notes: The first column top-down displays accumulated responses of the country’s output gap, the country’s inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. country specific output gap shock. The second column top-down displays accumulated responses of the country’s output gap, the country’s inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. country specific inflation shock. The third column top-down displays accumulated responses of the the country’s output gap, the country’s inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. EA output gap shock; the fourth column top-down displays accumulated response of the the country’s output gap, the country’s inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. EA inflation shock; the fifth column top-down displays accumulated response of the the country’s output gap, the country’s inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. interest rate shock. Dashed lines are upper and lower bounds of the 95% bootstrapped confidence interval. Source: own calculations.

Figure 1.4: French system



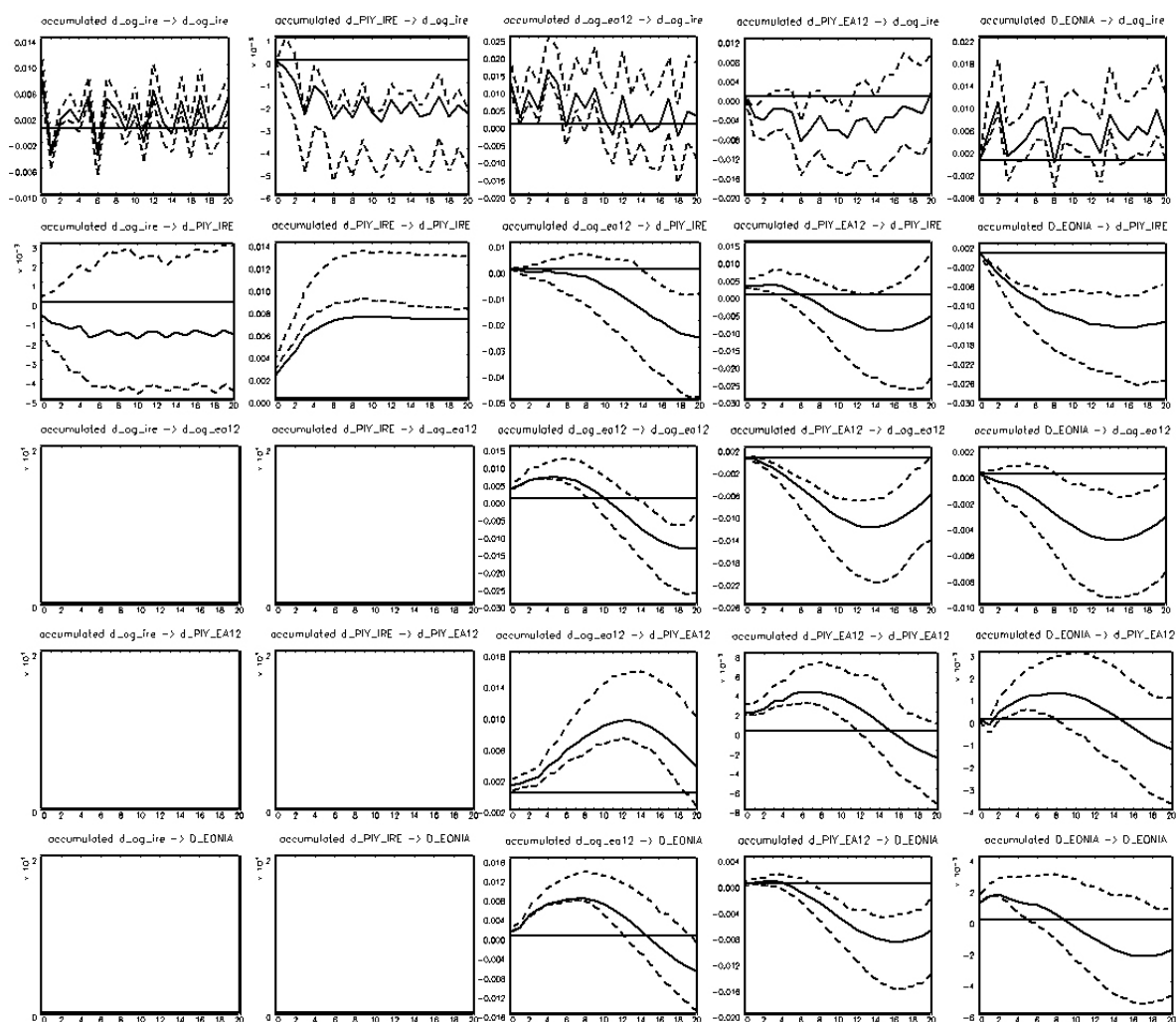
Notes: The first column top-down displays accumulated responses of the country's output gap, the country's inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. country specific output gap shock. The second column top-down displays accumulated responses of the country's output gap, the country's inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. country specific inflation shock. The third column top-down displays accumulated responses of the the country's output gap, the country's inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. EA output gap shock; the fourth column top-down displays accumulated response of the the country's output gap, the country's inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. EA inflation shock; the fifth column top-down displays accumulated response of the the country's output gap, the country's inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. interest rate shock. Dashed lines are upper and lower bounds of the 95% bootstrapped confidence interval. Source: own calculations.

Figure 1.5: Italian system



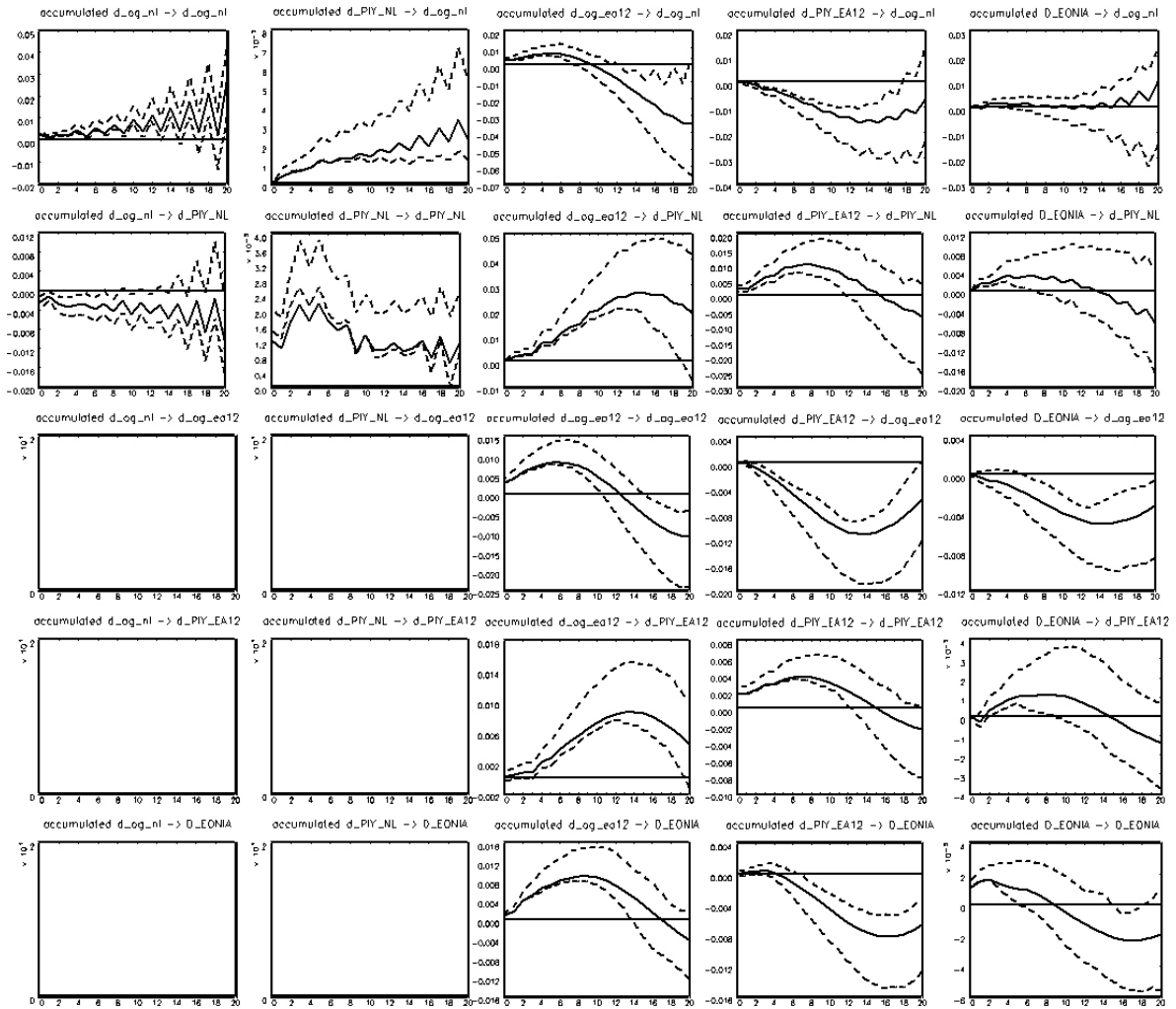
Notes: The first column top-down displays accumulated responses of the country’s output gap, the country’s inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. country specific output gap shock. The second column top-down displays accumulated responses of the country’s output gap, the country’s inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. country specific inflation shock. The third column top-down displays accumulated response of the the country’s output gap, the country’s inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. EA output gap shock; the fourth column top-down displays accumulated response of the the country’s output gap, the country’s inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. EA inflation shock; the fifth column top-down displays accumulated response of the the country’s output gap, the country’s inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. interest rate shock. Dashed lines are upper and lower bounds of the 95% bootstrapped confidence interval. Source: own calculations.

Figure 1.6: Finnish system



Notes: The first column top-down displays accumulated responses of the country's output gap, the country's inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. country specific output gap shock. The second column top-down displays accumulated responses of the country's output gap, the country's inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. country specific inflation shock. The third column top-down displays accumulated response of the the country's output gap, the country's inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. EA output gap shock; the fourth column top-down displays accumulated response of the the country's output gap, the country's inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. EA inflation shock; the fifth column top-down displays accumulated response of the the country's output gap, the country's inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. interest rate shock. Dashed lines are upper and lower bounds of the 95% bootstrapped confidence interval. Source: own calculations.

Figure 1.7: Irish system



Notes: The first column top-down displays accumulated responses of the country’s output gap, the country’s inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. country specific output gap shock. The second column top-down displays accumulated responses of the country’s output gap, the country’s inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. country specific inflation shock. The third column top-down displays accumulated response of the the country’s output gap, the country’s inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. EA output gap shock; the fourth column top-down displays accumulated response of the the country’s output gap, the country’s inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. EA inflation shock; the fifth column top-down displays accumulated response of the the country’s output gap, the country’s inflation rate, the EA output gap, EA inflation and the interest rate to a one s.d. interest rate shock. Dashed lines are upper and lower bounds of the 95% bootstrapped confidence interval. Source: own calculations.

Figure 1.8: Dutch system

Chapter 2

Financial Structure and its Impact on the Monetary Transmission Mechanism in Europe: A time-varying interest pass through model

2.1 Introduction

During the 1990s efforts to foster integration of the European market were intensified which led to an increase in the degree of integration. The single most outstanding event in the decade was the introduction of the common currency. This had - amongst other reforms - a strong impact on financial markets. Out of financial markets the money markets experienced the main push toward one single integrated market. Arbitrage opportunities were essentially reduced by the introduction of one currency managed by a single monetary authority through a single interest rate as well as a single euro area-wide payment system. Another indication for the increased integration is the stark increase in intra-EMU cross-border interbank lending over the 1990s till now. (Hartmann et al. 2003)

The integration of capital markets is not so pronounced, but there is evidence that capital market movements have synchronised over the last decade. (see Fratzscher 2001) The lesser degree of integration in capital markets points at factors which cannot simply be eliminated by the removal of cross-border transaction risk, stemming from exchange rates and divergent interest rates.

Therefore differences in financial structure were preserved in the course of European financial integration. As a result, intermediaries, which are of considerable importance within the financial structure of economies, play different roles, which is reinforced by the fact that only few cross-country mergers were observed in the EMU area until 2002.(see Schmidt 2001) The concentration on bank lending as well as the lack to draw resources from capital markets

directly might also be rooted in the origin of the legal system in the country under consideration, as was put forward by a number of authors such as La Porta, Lopez-de Silanes, Shleifer & Vishny (1997), La Porta, Lopez-de Silanes, Shleifer & Vishny (1998) and Cechetti (1999). Summing up, financial structure will have a considerable impact on the operation and effects of the European central bank and is likely to lead to asymmetries in the European monetary transmission. (Mojon 2000)

As Amable (2003) demonstrates, even though there was some considerable transformation of financial structures within the last twenty years, most notably in France (compare also Hackethal, Schmidt & Tyrell 2002) due to privatisation of the banking sector and capital market reforms, through privatisation of parts of the economy other than banking and pension reforms, financial structures are far from being uniform. This assigns different importance to intermediaries such as banks throughout Europe. Banks will, depending on the environment they operate in, reinforce or stand against actions of the central bank. In bank-based financial systems, they will stand by their related customers and provide resources even in a time of monetary tightness. Ehrmann et al. (2003) stress the importance of banking networks, such as loan cooperatives and savings banks in some EMU economies like France, Germany, Austria and Finland. The question that therefore arises is whether differences in financial structure in Europe facilitate the operation of monetary policy of the European Central Bank or not as financial structure seems to determine the nature of monetary transmission mechanism through interest rate setting behaviour.

Cottarelli & Kourelis (1994) were the first to estimate the degree and speed of pass-through of interest rates trying to link the effects of monetary policy in various countries on banks and explaining it by financial structure variables. They show that there is significant influence of financial structure on the monetary transmission mechanism which differs between various countries. There are three other studies that seem to be of importance for the topic above. Mojon (2000) estimates the interest pass-through by a vector error correction model (VECM) for a rather large variety of different interest rates for some economies of the euro area for various subsamples up until 1998. Therefore it is not possible to draw any conclusions about the effects of the introduction of the common currency. De Bondt (2005) also estimates interest pass-through VECMs for the euro area as a whole between 1996 and 2001. Again, as for Mojon this specification does not allow to test for convergence issues as a VECM implies that there is no adjustment to a new equilibrium but to the old. This is unlikely to occur when a new policy regime like a common currency is introduced. With respect to convergence Haan, Sturm & Toolsema (2001) provide interesting insights. In contrast to De Bondt (2005) they estimate interest channels for a small set of individual member states of the European union. They secondly let the pass-through parameters in contrast to VECMs vary over time to tackle the question whether differences in interest pass-through across countries vanish over time due to the introduction of the euro. They find however little evidence of convergence, but this may be due to the relatively short span of the euro in operation. This paper tries to redo on the one hand the analysis of Haan et al., as we have a longer period of the euro in operation. On the other hand it goes beyond their analysis in terms of countries covered and the convergence analysis undertaken combined with financial structure considerations.

Thirdly it investigates the role of financial structure as an explanation for the differences in the immediate interest pass-through in the European economies under consideration.

To test for the influence of the financial structure the following hypotheses will be evaluated:

Hypothesis 1 *There is convergence in the transmission mechanism within the EMU member states.*

Hypothesis 2 *There is faster convergence between countries with similar financial structures than between economies with different financial structures.*

Hypothesis 3 *Due to the rigidity of financial structures there will not be any significant speeding up of convergence in the European monetary transmission mechanism due to the introduction of the euro.*

These three hypotheses lie at the heart of this paper. The first tests whether there is convergence at all. Given that there is convergence, hypothesis 2 states that one should see a faster pace of convergence between countries with similar financial structures which was not considered in Haan et al. (2001). The third hypothesis then aims to disentangle exchange rate risk and the financial structure effect. So if all three hypotheses cannot be rejected we have established that it is the financial structure that is important for the degree of asymmetry.

The remainder of the paper is organised as follows. Section 2.2 estimates and discusses the main characteristics of the underlying econometric model. The second part 2.2.2 will present the main results of the first step of the analysis. Section 2.3 presents the three ways convergence and financial structure are linked in the paper, Sigma convergence, cluster methods and panel regression analysis. Section 2.4 will conclude.

2.2 The Effects of Monetary Policy

2.2.1 The model

In this section we estimate the pass-through of monetary policy impulses through the banking system of most old-EU economies. Even though this was done to some extent by Mojon (2000), the specification differs in this study as we take into account the dynamics of monetary integration. In contrast to Mojon (2000) the rolling regression technique is used to assess the time variation in the estimators. Furthermore we do not estimate cointegrating relationships between bank and policy interest rates as it is not clear whether there exists such a stable relationship or whether it has changed due to the introduction of the euro. In this case we would estimate something that does not exist, a stable long run relationship between bank lending and money market rates. The data coverage is the third distinguishing feature of this analysis. Last but not least, due to data availability, only a general bank lending rate instead of more precise bank interest rates was used. As a baseline, the model used follows the approach of Cottarelli & Kourelis (1994), which also forms the basis of Mojon's (2000) model.

Cottarelli & Kourelis (1994) model assumes that financial intermediaries such as banks are not neutral transmitters of monetary policy impulses. This is motivated by the observation that bank rates are relatively inelastic with respect to shifts in the demand for loans as well as deposits and that bank rates change less in magnitude than do money market rates.

As a first step, an equation that links bank lending rates to money market and discount rates is considered¹:

$$\begin{aligned} \Delta i_{j,t} = & \alpha_{j,1} + \alpha_{j,2}\Delta i_{j,t-1} + \beta_{j,0}\Delta d_{j,t} + \dots + \beta_{j,k}\Delta d_{j,t-k} + \\ & \gamma_{j,0}\Delta m_{j,t} + \dots + \gamma_{j,n}\Delta m_{j,t-n} + u_{j,t}, \end{aligned} \quad (2.1)$$

where $\Delta i_{j,t}$, $\Delta m_{j,t}$ and $\Delta d_{j,t}$ represent changes of the *lending* rate, *money market* rate and the *discount* rate at t for country j , where $j = 1, \dots, J$. The values of β and γ will vary over the countries in the sample, therefore there will be a different degree of stickiness in the interest rates in every country. Using the β and/or γ vectors, various sets of multipliers are derived, which will be in general nonlinear functions of the two parameter sets, and are given by

$$h_{m,0} = \gamma_{j,0}, \quad (2.2a)$$

$$h_{d,0} = \beta_{j,0}. \quad (2.2b)$$

$$h_{m,t+p} = \alpha_{j,2}^p \gamma_{j,0} + \dots + \alpha_{j,2} \gamma_{j,p-1} + \gamma_{j,p} = \sum_{i=0}^p \alpha_{j,2}^{p-i} \gamma_{j,i}, \quad (2.3a)$$

$$h_{d,t+p} = \alpha_{j,2}^p \beta_{j,0} + \dots + \alpha_{j,2} \beta_{j,p-1} + \beta_{j,p} = \sum_{i=0}^p \alpha_{j,2}^{p-i} \beta_{j,i}. \quad (2.3b)$$

In the discussion we shall however mainly focus on the money market multiplier, taking into account the direct effect of monetary policy in some countries.

2.2.2 Results

Before showing the multipliers implied by the estimated country models, a few words about the model selection methodology. The country models are based on Cottarelli and Kourelis, and the optimal lag length was chosen by minimising the AIC criterion. As during the 1980s monetary policy did not solely rely on discount rate manipulation but also on other means such as credit control, the model selection was also undertaken to chose between estimating a pure bank lending lending rate and money market rate model as well as a model that additionally included the discount rate of the central bank in the respective country. There is

¹This equation corresponds to Cottarelli & Kourelis's (1994) model 2. Model 1 is in levels for the lending rates and money market rates, whereas the discount rate is in differences. The reason for that is that they want to control for policy changes which are signals to the market. Model 2 was chosen because nearly all interest rates of the countries investigated here are not stationary in levels, so that a model in first differences is more appropriate.

evidence in nearly every country, as figure 2.5 shows, that excluding the discount rate for the whole sample leads to a misspecification of the interest rate pass-through models, as there is additional information in the discount rate, that is not captured by variation in the money market rates alone.

For the assessment of the impact of European monetary policy discount rates of central banks exert a statistically positive influence on bank lending behavior. Not taking this into account leads to misspecified models for these countries.

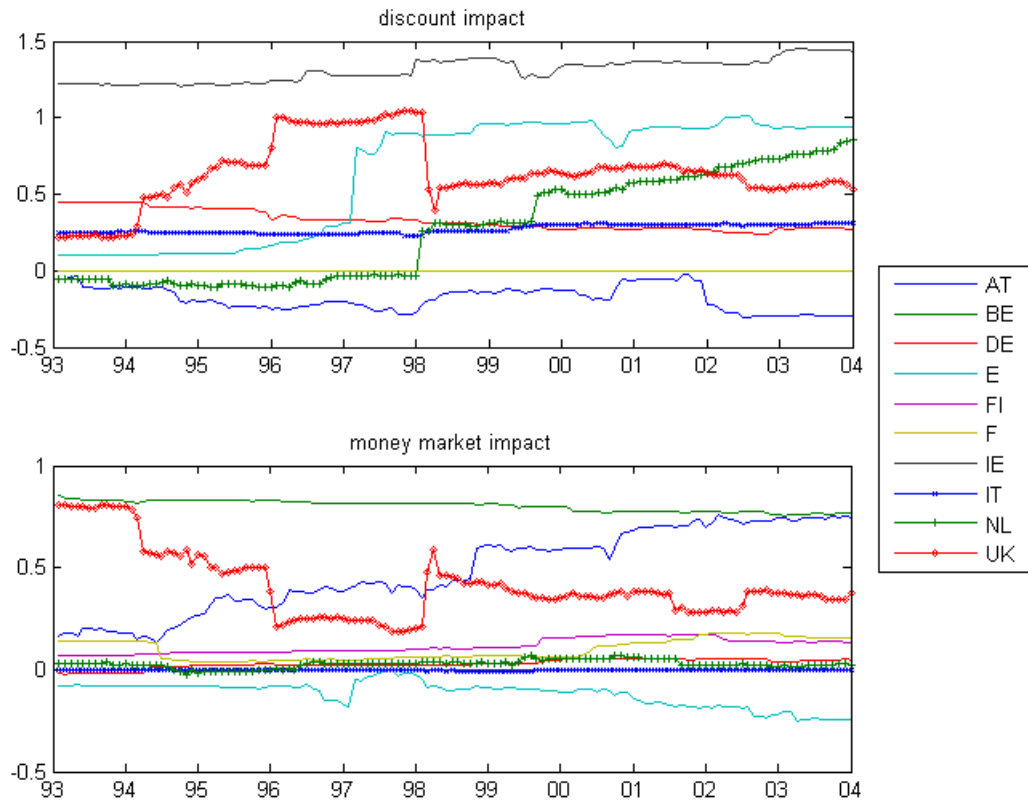
Figure 2.5 in the appendix plots the difference of absolute values between the absolute value of the AIC of the money market rate only model and the absolute value of the AIC of the model that also includes the discount rates over time. If the difference is positive, then we would select the money market rate only model, if negative we would do the opposite. In the cases of Belgium, Ireland, Italy and the Netherlands it can be seen that the inclusion of the discount rate makes the mixed specification better over time, whereas in France and Finland the difference is stable at slightly below zero. For the case of Austria and the UK the money market rate only specification is preferable². Nevertheless in order to ensure comparability with the other models the discount rate was included. For Finland the money market only model was chosen, as there is not such a big difference between both specifications on the one hand and because the discount rate series for Finland only begins in 1987, which considerably restricts the number of estimation subperiods. The exact specifications which were chosen are shown in the appendix.

The money market multipliers

Figure 2.1 shows some important results. Only the impact multipliers are shown, but figures 2.6 and 2.7 in the appendix will show some of the patterns at the beginning and at the end of the sample period. As these figures show, the model mainly characterises the first four periods following a money market rate shock. For the fifth and sixth we find hardly any significant movement. This is in line with the analysis of Cottarelli & Kourelis, as they have firstly set up a model analysing the short run effects only, which secondly produces significant multipliers up to the third lead. This can be justified on the basis of economic theory as in the long(er) run other factors such as the demand for loans are important determinants for bank lending rates.

The impact multipliers for market oriented economies like the Netherlands or the UK are stronger than for typical bank-based economies such as Germany. Also, as Hackethal et al. (2002) and Amable (2003) explain, France was moving toward the group of market-oriented economies due to structural reforms in the mid-1980s. This development becomes dominant at the end of the time span. Thus, the French banks' response to money market movements

²This is interesting, as we would expect that in the case of the UK as a market-based financial system money market rates convey the important information about monetary policy due to deep interbank markets already in the 1980s, whereas in Austria we would assume that as banks dominate financial markets the opposite would occur: this means for Austria that the money market interest rate should not be very informative. It could probably be that in case of Austria, the money market rate is the only interest rate that conveys information about monetary policy, as Austria did not undertake a monetary policy independently of that of the German Bundesbank since the late 1970s. Thus, the Austrian discount rate is not informative at all.



Source: own calculations.

Figure 2.1: Impact Multipliers

is stronger in latter regressions than in previous.

Belgium and Austria deserve special attention. According to Amable (2003) Belgium displays the second lowest intermediation ratio of all EMU countries with a declining tendency. As a consequence it is not surprising that money market impulses are transmitted quite strongly. On the other hand Austria remains puzzling. As Amable shows Austria has by far the persistently highest degree of intermediation, which could explain the outstandingly high transmission after three months. But what remains puzzling is the high degree of transmission at impact.

2.3 Impact of Financial Structure

To link the multipliers to financial structure variables, Cottarelli & Kourelis (1994) suggest that they depend on the structural features of the financial structure of the economy:

$$h_{j,l} = Z_j \eta_l + v_{j,l} , \quad (2.4)$$

where Z_j is a n -element vector describing the financial structure of the economy j and $v_{j,l}$ are errors that are not correlated between the countries. Taking together all countries the multiplier system can be re-written in the following matrix form:

$$h_0 = Z\eta_0 + v_0, \quad (2.5)$$

where Z is a $J \times K$ matrix and $l = 0$, so that h_0 is the impact multiplier. In a similar manner medium and long term multipliers can be formulated,

$$h_l = Z\eta_l + v_l. \quad (2.6)$$

These equations enable us to study the effects of financial structure on the effects of monetary policy in the various countries. While subsection 2.3.1 will deal with the multipliers and look at the development of these over time, subsection 2.3.3 will discuss the direct effect of financial structure on the transmission of monetary impulses.

The empirical model combined with the rolling regression technique allows to track changes in the relationships we are interested in. There are various ways to characterise financial structures of economies: We consider two concepts, the first being the *legal family concept* due to La Porta et al. (1997) and for the second we follow a clustering suggested by Amable (2003).

The idea behind the concept first introduced by La Porta et al. (1997) is that the legal origin of the countries' law code matters for the role capital markets play within the economy, as they differ with respect to shareholder and investor protection. They globally find four main families:

1. common law (English legal family)
2. civil law
 - (a) French legal family
 - (b) Scandinavian legal family
 - (c) German legal family

Civil law countries do give fewer rights to parties in capital markets, but the rights are strongest enforced in German and Scandinavian countries.

By principal component and cluster analysis Amable (2003) pins down four groups which are similar to the legal family grouping, but not entirely the same. He finds a factor that explains 45 percent of the total variation, and which is defined by negative and positive components:

1. **negative:** stock market cap. to GDP, ownership of large listed companies, percentage of share held by institutional investors, M&A activity, accounting standards, importance of venture capital

2. **positive:** ownership concentration, scope of public ownership, share of the the public sector, control of large firms by families, share of bonds in institutional investors' portfolios

From this first step he performs a cluster analysis and finds four groups,

1. high level of protection, high importance of stock markets and institutional investors, low public ownership:
USA, Canada, UK, Switzerland, Australia and Japan
2. larger than average control of firms by financial institutions:
France, Norway and Sweden
3. low importance of family control:
Ireland, Denmark, Finland and Austria
4. ownership concentration, lack of coherence to international accounting standards, low M&A activity, low development of capital markets:
Germany, Spain, Italy Portugal and Greece

These two groupings will be taken as suggestions by theory in the first two parts of this section. To gain more robust evidence the following three ways are undertaken to assess potential changes, Sigma convergence, cluster analysis and panel regression analysis.

2.3.1 Sigma-Convergence

Concept

The concept of *sigma-convergence* originally stems from the growth literature. It states that there is convergence (in growth) between a group of economies if the variation (in growth rates) within the group declines over time. This is of course a more general idea that is also applicable to other notions of convergence as well.

More explicitly, we are interested in the development of some kind of dispersion measure such as the standard deviation,

$$\sigma_K = \sqrt{\sum_{j=1}^K (m_j - \bar{m}_K)^2}, \quad (2.7a)$$

where K is a group of k countries and m is the respective multiplier.

As different different groups may have different means this might bias the results and thus lead to the wrong conclusions. Taking the different means into account we will alternatively consider the coefficient of variation, which is defined as

$$cv_K = \frac{\sqrt{\sum_{j=1}^K (m_j - \bar{m}_K)^2}}{\bar{m}_K}. \quad (2.7b)$$

For this purpose the appropriate groups have to be defined. These groups should be found by using an appropriate measure for the financial structure.

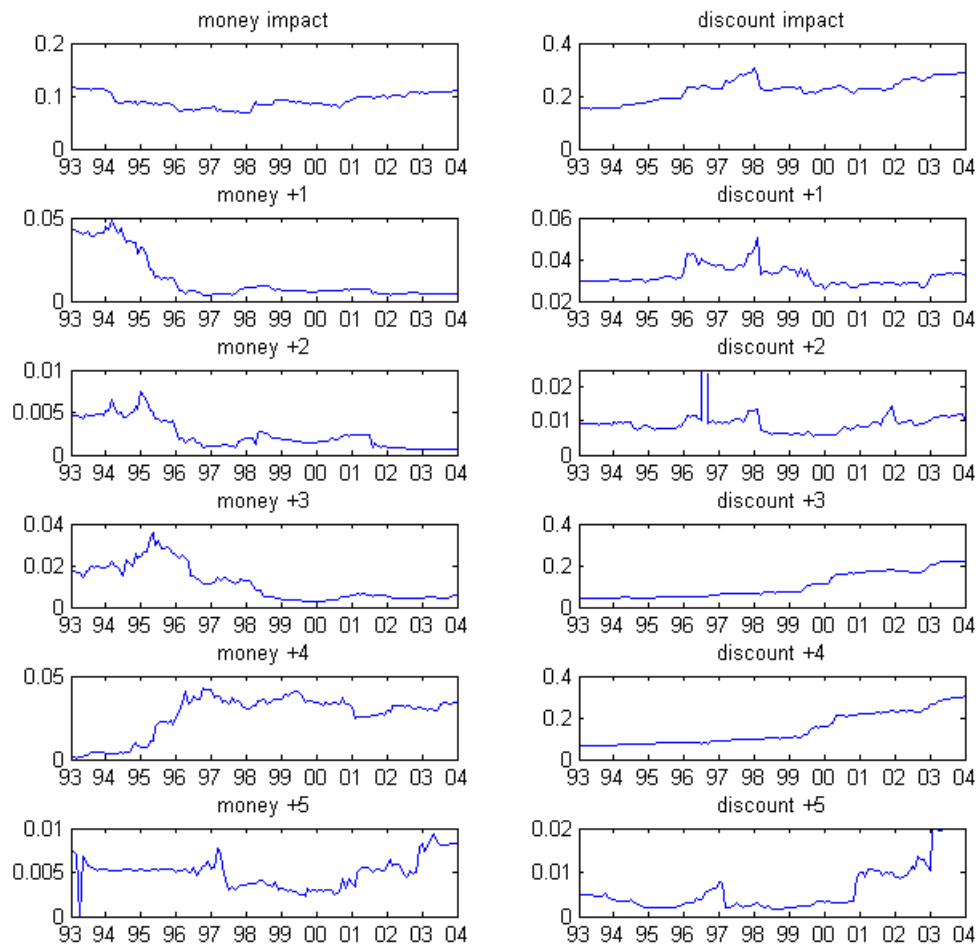
Results

Figures 2.2, 2.3 and 2.4 not only give the grouping effect according to financial structure, but let us also assess possible convergence patterns across countries, over time and over the periods following a shock in the money market as well as discount rates.

Overall effects

Figure 2.2 displays convergence patterns distinguishing between money and discount rates. We find that there is a clear trend towards a more uniform reaction of banks after one to three months (compare the second to fourth graphs in the left hand side panel of figure 2.2). This pattern clearly emerges in the late 1980s/ early 1990s, as the mass of observations are in the subsamples at the beginning. However for the discount rate multipliers there is a clear trend toward diversity over the 1990s and the beginning of the new century. From the discussion about measuring monetary policy and the relative importance of money market and discount rates we have to give more weight to the money market rate, especially as the discount rate multiplier is not included in a third of the economies involved. Summing up we cannot reject hypothesis one, even though there seems to be a contrary development for the impact multiplier and the reaction four to six months after the interest rate movement.

It should be noted at this stage that the convergence measures for figures 2.2, 2.3 and 2.4 differ in the sense that figure 2.2 uses the ordinary standard deviation measure, whereas in the latter two figures coefficients of variation are displayed.



Source: own calculations.

Figure 2.2: Variance of Multipliers

Legal Family

Looking at the money market rate first, grouping according relative to legal families does have an important influence on the variation of bank behavior in the first three and the fifth months after the movement in the money market and only these are shown. The remaining months are not shown for presentational clarity. For the impact multiplier no significant impact can be found, as the response of the French legal as well as the German legal families tend to diverge over time. In case of the French family this seems to have to do with the money-market effect in Belgium, which is by far larger than in all the other economies within this group. For the German legal family this divergence seems to be driven by the Austrian development.

There is convergence in monetary transmission in Europe in the 1990s. This convergence can be observed in the first three months following a money market rate shock.

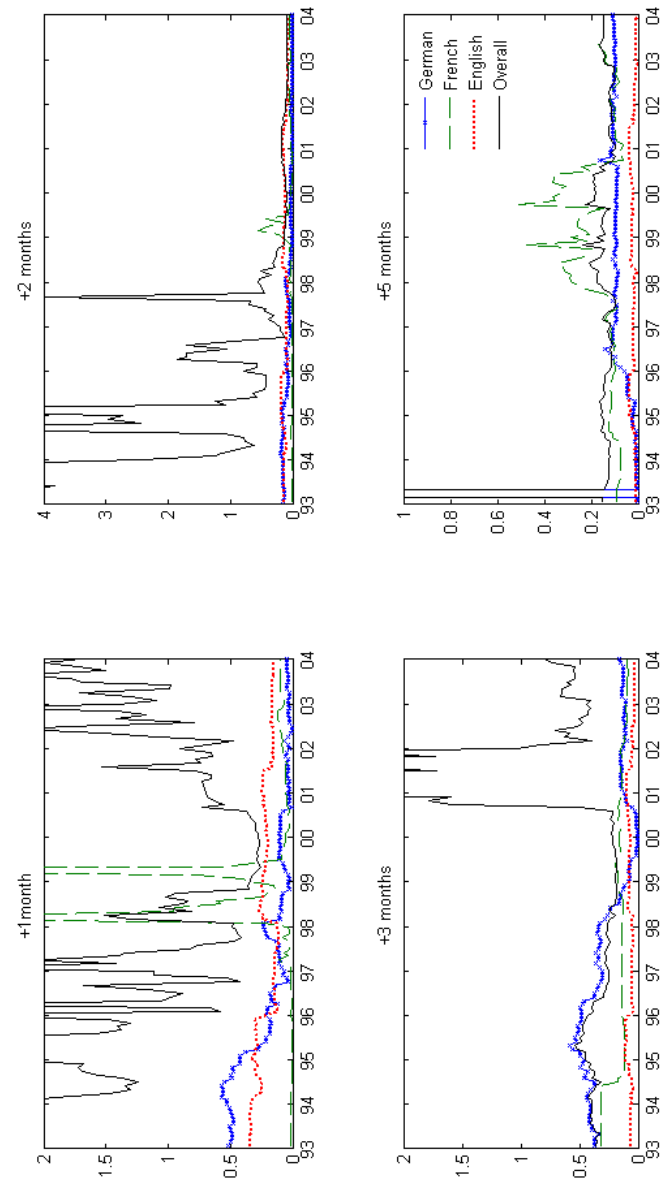
Financial Structure

Looking at financial structure from a less historical perspective using the *Amable-factors* a problematic feature is that we have to drop the Netherlands and can only look at group 3 and 4 because we only have the UK of group 1 and from group 2 we only have France. Therefore it does not make sense to look at deviation measures for the first two groups.

For the money market (figure 2.4) grouping makes sense for five out of six cases (5th month after the change in the money market rate). Similar to the legal family distinction a significant grouping effect for the impact and the first three months after the change in the money market rate is obtained. This seems to be robust across the two grouping procedures.

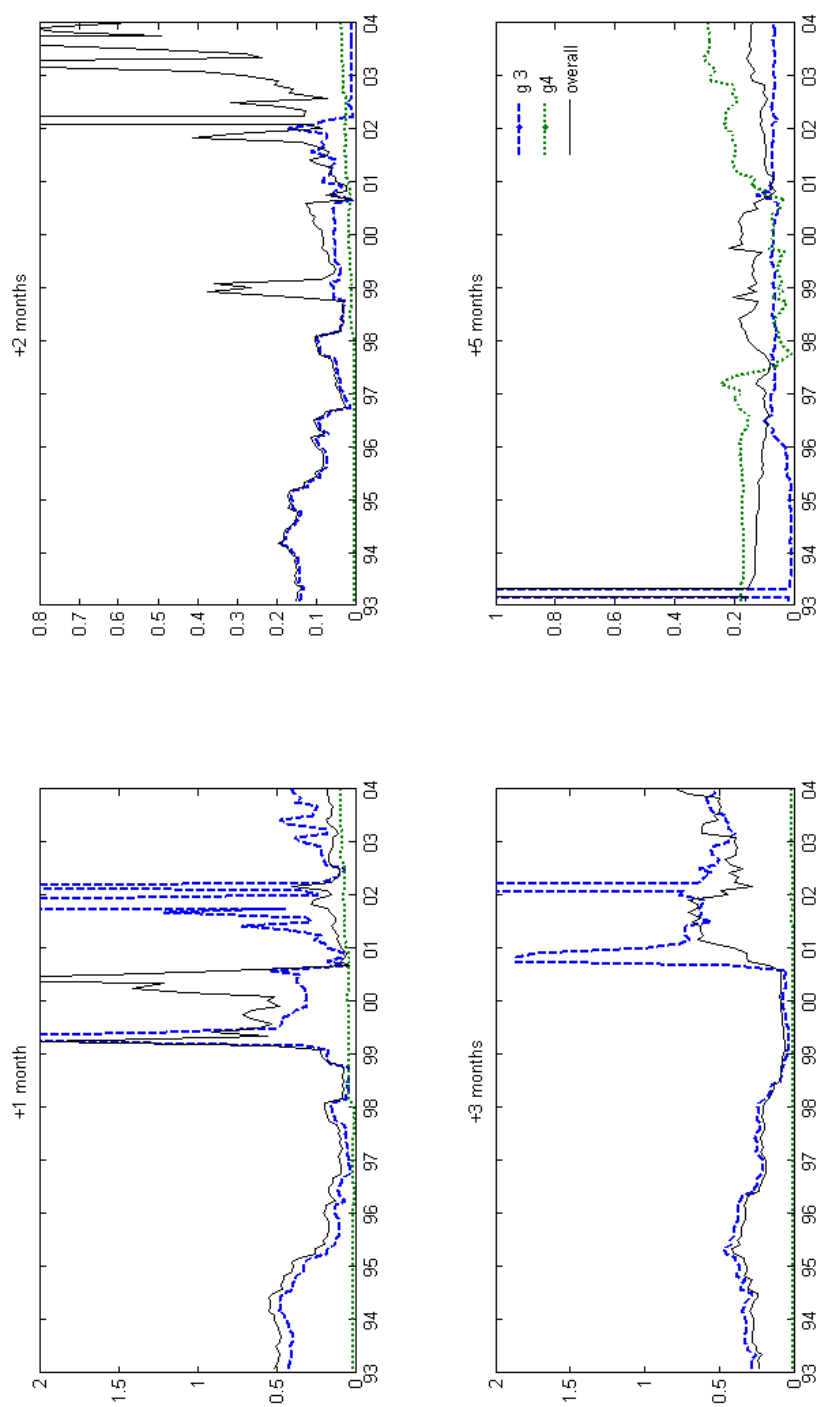
Given the convergence in Europe following a money market shock in the first three months, the dispersion between countries with similar financial structure is further reduced. There is a significant impact of financial structure on the convergence of the European monetary transmission.

The conclusion is that there is a clear pattern of convergence in the money market in the first three months following an interest rate movement. This is even reinforced when we look at the grouping motivated by financial structure considerations. Not only do we find convergence in these months, but the variation in countries with similar financial structure is also lower in these economies. This might be interpreted as an indication that financial structure influences the convergence of the monetary transmission mechanism.



Source: own calculations.

Figure 2.3: Variation due to legal family



Source: own calculations.

Figure 2.4: Variation due to financial structure

2.3.2 Cluster Analysis

Concept

The cluster approach³ turns the problem of σ -convergence upside down, as from only observing the estimated multipliers groups will be formed. It is interesting whether the groups that are formed on the basis of some measure that will later correspond to the groups that financial structure would predict.

For our purposes we define for each sample period $n = 1, \dots, N$ and country $j = 1, \dots, J$ a point

$$s_{n,j} = (h_{j,m,0}, h_{j,d,0}, \dots, h_{j,m,p}, h_{j,d,p}), \quad (2.8)$$

where p are again periods ahead, h are the multipliers and m and d refer to the money market and discount rates respectively.

Starting with $s_{n,j}$ groups on the basis of minimizing the distance between the country points, groups with similar characteristics will be formed. The classical concept of distance between points is *Euclidean distance*, which is defined as follows. Take any two points $s_i = (x_1, x_2, \dots, x_p)$ and $s_j = (y_1, y_2, \dots, y_p)$, the Euclidean distance is defined by

$$d_{i,j} = [(x_1 - y_1)^2 + \dots + (x_p - y_p)^2]^{1/2}.$$

In general there are two ways to do cluster analysis, **hierarchical** and **non - hierarchical** clustering. The first class can be divided into *agglomerative* and *divisive* methods. In case of the agglomerative method J clusters are the starting points, such that each country forms a cluster. The two closest clusters are successively combined until only one cluster, which consists of the whole group, remains. Divisive methods start from the biggest available group and step down until there are exactly J groups. A popular way to find the closest cluster to a given cluster is the centroid technique. For the agglomerative cluster method each cluster consists of only one point. The centroid is the point the coordinates of which are just the mean of all coordinates of the points in the respective cluster. So at the start each point is the centroid of its own cluster. Then the two points the centroids of which are closest are grouped into one cluster. Afterwards the minimal distance between the centroids of all clusters is searched and the two clusters with the minimal distance form another cluster and so on until one single cluster is left.

A popular **non-hierarchical** clustering technique is *k-means clustering*. For this method the points are grouped into K clusters by some method. The centroids of these clusters are calculated. Then the distance between every point in the set and the centroid of each cluster is calculated. If it is closest to its own centroid the point is kept within the group. If not it is assigned to the group the centroid of which it is closest. This is repeated until no point is re-assigned.

³The discussion of cluster analysis follows closely Afifi, Clark & May (2004), chapter 16.

Results

In the following subsection another way of detecting convergence is presented. Given the sets of multipliers for the economies, can groups be identified and if yes, do these correspond closely to the ones, the grouping of which is motivated by *legal family* or *financial structure* groups?

For this purpose we first consider partitional clustering and look at the four group stage given in tables 2.1 and 2.2.

	group			
	1	2	3	4
1994	ie	at	de,e,f,fi,it,nl	uk, be
1995	ie	at, f, fi, nl	de,e,it	uk,be
1996	ie	at, be	de,e,f,fi,it,nl	uk
1997	ie	at, be, f, fi, nl	de,e,it	uk
1998	ie	at, be	de,e,it,uk	nl,f,fi
1999	ie, e, uk	at, be	de,f,fi,it,nl	it
2000	be	at	de,e,f,fi,ie,nl,uk	it
2001	ie	at, be	de,e,f,fi,nl,uk	it
2002	ie	at, be	de,f,fi	e,it,nl,uk
2003	ie	at	de,e,f,fi,it,nl,uk	be
2004	ie	at, be, f, fi	de,nl,uk	e,it
grouping	ie	at, be	de,e,f,fi,nl,it	uk

Source: own calculations.

Table 2.1: Partitional Cluster Analysis: **both multipliers**

Looking at the overall effect a clear separation of the Common Law system from the Civil Law system can be observed, as both, Ireland and the UK are clearly separated over the individual years as well as on average. The difference between German and French law system seems to be less pronounced in comparison, as France and Germany (as well as Belgium and Austria) are often grouped into the same category. It is interesting that in every year, France and Finland seem to be closest, as they are always in the same group.

Taking the other proposed proxy for financial structure proposed by Amable, there seems to be a clear contradiction to Amable's (2003) results, as France (an Amable group 2 country) and Germany (an Amable group 4 country) are grouped almost always in the same group in this analysis. What is in accordance with Amable (2003) is the grouping of Italy, Germany and Spain in the overall consideration.

Additional to that a hierarchical cluster method was undertaken, which is summarised in table 2.3. Dissimilarity between the economies increased in the late 1990s, but decreased after 2000, which is compatible with the results obtained from the section on sigma convergence. Another similarity can be seen in table 2.1 that Ireland and the UK occupy a special position, and most European economies are grouped into one group, which appears to be growing over time.

Observing the pattern of monetary transmission mechanism we cannot identify groups

Table 2.2: Partitional Cluster Analysis: **money market multipliers**

	group			
	1	2	3	4
1994	at	de,e,ie,it	f,fi,nl	be,uk
1995	at	de,f,fi,ie,it,nl	e	be,uk
1996	at	de,f,fi	e,ie,it,nl	be,uk
1997	at,be	de,f,fi,ie,it,nl	e	uk
1998	at,be	de,f,fi,ie,it,nl	e	uk
1999	at	de,f,fi,ie,it,nl,uk	e	be
2000	at,be	de,f,fi,ie,it,nl	e	uk
2001	at,be,uk	de,f,ie,it,nl	e	fi
2002	at	de,e,ie,it,nl	be	uk,f,fi
2003	at	de,f,fi,ie,it,nl	e	uk,be
2004	at,be	de,ie,it,nl	f,fi	uk
grouping	at	de,f,fi,ie,it,nl	e	uk

Source: own calculations.

	minimal distance* for 4 clusters	group			
		1	2	3	4
1995	0.92	at, f, fi, nl	de, e, it	ie	be, uk
1997	1.02	at, be	de, e, f, fi, it, nl	ie	uk
2000	1.03	at, be	de, f, fi, it, nl, uk	e	ie
2003	0.68	at, be	de, f, fi, it, nl, uk	e	ie

*Euclidean distance metric; own calculations.

Table 2.3: Hierarchical Cluster Method

according to their financial structure. Considering the subset of money market multipliers the UK still differs from the rest of Europe, but also Austria is separated. This latter observation can potentially be attributed to the strong and dominant impact effect of the Austrian money market on bank-credit interest rates. Another difference to table 2.1 is that Spain is nearly always singled out. Again the difference between French and German legal families does not seem to be too strong overall. As far as Amable (2003) is concerned the money market multiplier that groups 3 and 4 (with the notable exceptions of Austria and Spain) seem to have merged. So judging from cluster analysis we cannot fully identify groups due to financial structure from only looking at the response of banks in the respective economies.

2.3.3 Panel Regression Analysis

Concept

Another way to assess the impact of financial structure on monetary transmission is to estimate it directly by a panel regression. Within this framework proxies for the financial structure can be directly tested for their influence on monetary transmission, in this case on the multipliers of the money market as well as the discount rate multipliers. By a panel regression the (set of) economy(ies) we are interested in can be accounted for more directly.

More formally we have the following system:

$$h_{0,(j,t)} = Z_{jt}\eta + u_{j,t} , \quad (2.9a)$$

$$u_{j,t} = \mu_j + \nu_{jt} , \quad (2.9b)$$

where $j = 1, \dots, J$, $t = 1, \dots, T$, Z_{jt} is a vector of financial structure variables, μ_j measures the individual effect in country j , and $\nu_{jt} \sim N(0, 1)$ is a disturbance term.

The parameter vector η accounts for the influence of financial structure on the transmission of monetary policy impulses. We first require all the parameters to differ significantly from zero. As we also take into account time we will incorporate the euro effects and this will have of course influence the estimation of the parameters.

If we were to account for changes over time, we could slightly change the specification of equation (2.9b) to

$$u_{j,t} = \mu_j + \lambda_t + \nu_{jt} , \quad (2.9c)$$

where λ_t measures the time-specific effects. The model comprised of equations (2.9a) and (2.9c) is typically referred to as a two-way panel.

The following structural variables will be used:

1. *Volatility of of the money market:*
residuals from an ARMA(p,q) fitted to the money market rate
2. *Capital market deepness:*
ratio of domestic market capitalisation to GDP

3. Degree of intermediation:

- (a) bank deposits to GDP and
- (b) bank credits to GDP (both overall and non-financial corporations)

To account for other influences also inflation is included in the panel regression estimates. From the previous discussion the following expectations can be made about the influence of financial structure variables.

In an economy where financial structure matters all variables have a significant influence on the multipliers. In countries with a higher degree of intermediation volatility and capital market deepness exerts a lesser whereas the degree of financial intermediation exerts a higher influence on the multipliers. In bank (or relationship) based economies the latter effect is expected to dominate the other two and thus a negative individual effect (μ_j), which is reversed for the market based (or arm's length) economies.

Results

Of the countries investigated previously we unfortunately had to drop UK and Ireland as for the UK there are not bank deposit series in the IFS database and for Ireland the market capitalisation is only published from 1994 onwards. Whether to include Ireland or not is debatable, even if the data were observable, as it is expected that the inclusion of this economy would have distorting effects on the results due its fast growth during the 1990s. As table 2.9 in the appendix shows there is no significant difference between the one- and the two way models, whereas the poolability tests indicate that estimating a pooled regression is worse than estimating a panel regression model. In order to achieve parsimony, the one-way fixed effects model was chosen. Given that there are only 8 countries in the sample a fixed effects model is clearly the better choice over a random effects model. Five specifications were estimated.

In table 2.4 the variables market capitalisation(*mc*), bank deposits to GDP (*bd*) and the yieldspread (*ys*) influence the impact money market multiplier significantly. Starting with the maximum specification as discussed above we consecutively dropped all insignificant variables until all variables were significant. This was done in a way to avoid a decrease in the adjusted R-squared. If such a decrease occurred we would have left the otherwise insignificant variable in the regression. The variable *bd* shows a positive influence on the multiplier as expected. As the influence of banks channeling funds from households to firms increases so does the rigidity of banks with respect to money market movements. The negative coefficient of *mc* is not easily interpretable. It could probably be explained by the fact that if banks dominate the stock market, the higher their influence in capital markets the lower the power of the market to compete with the banks. This crucial implication depends on the assumption that banks are dominant players in capital markets. The yield spread is the third source of influence, and it has a positive effect. Considering a positive spread, when the margin between long and short term interest rates widens, it becomes more attractive for banks to adjust their portfolio. This is due to the fact that every adjustment is costly and therefore only adjustments are undertaken if the gains from rebalancing the portfolio exceed the corresponding costs. This occurs more often the bigger the spread in yields.

	(1)	(2)	(3)	(4)	(5)
market cap.	.0005 (.0009)	-.0016 (.0005)	-.0018 (.0006)	-.0020 (.0006)	-.0019 (.0006)
bank dep./GDP	-2.1510 (.5286)	2.7579 (.5588)	2.6056 (.5907)	2.5071 (.5828)	2.5713 (.5842)
yieldspread	.0115 (.0181)	.0202 (.0058)	.0165 (.0074)	.0154 (.0067)	.0194 (.0076)
AT	-	.1980 (.054)	.1896 (.0547)	.2004 (.0533)	.2333 (.0660)
BE*	-	.2735 (.0354)	.2981 (.0466)	.3112 (.0442)	.2959 (.0461)
DE*	-	-.5639 (.039)	-.5429 (.0469)	-.5319 (.0449)	-.5455 (.0464)
E*	-	-.7372 (.0443)	-.7116 (.0545)	-.6972 (.0524)	-.7118 (.0539)
F*	-	-.5711 (.0561)	-.5483 (.0629)	-.5322 (.0622)	-.5395 (.0624)
FI*	-	-.5314 (.0460)	-.4924 (.0666)	-.4702 (.0630)	-.4921 (.0658)
IT*	-	-1.0127 (.1129)	-.9708 (.1243)	-.9462 (.1216)	-.9685 (.1229)
NL*	-	-.5653 (.0430)	-.5226 (.0679)	-.4972 (.0645)	-.5191 (.0671)
t	-	-	.0043 (.0053)	-	-.0145 (.0128)
t^2	-	-	-	.0006 (.0004)	.0017 (.0011)
Obs.	80	80	80	80	80
Adj. R-squ.	0.1525	0.9498	0.9496	0.9505	0.9507
F-Stat.	5.74	150.55	136.25	138.99	128.06

Notes: Standard Errors in parentheses; * relative to Austria; own estimation.

Table 2.4: Panel Regression Results

Financial structure significantly influences the extent of monetary transmission, because financial structure factors exert a significant impact on the magnitude of transmission of interest movements by European banks.

Furthermore all country dummies are significant. Belgium, which displays the lowest intermediation ratio, has also a bigger multiplier than Austria. Netherlands and France which usually display low degrees of intermediation have however a smaller intercept term than Austria. This could be attributed to the fact that French and Dutch banks are more international, which dampens the necessity for banks to react to domestic money market developments.

We consecutively eliminated insignificant explanatory variables, still the signs were preserved and the variables mc , bd and ys stayed significant.

From specifications (3) - (5) there is no significant and common influence of the trend, neither linear nor quadratic on the impact multiplier. Also the sign of the coefficients remain unchanged. As however only 10 time points could be used this should be treated with caution. After the inclusion of various forms of trends the influence of the proxies for financial structures are reduced whereas the influence of country specifics are more pronounced, which could be interpreted as an indication for a change. The adjusted R-squared indicates that model (5) is preferred to model (3), indicating a negative non-linear trend for $h_{0,m}$.

2.4 Conclusions

This paper has several objectives. First it tries to investigate how to best assess the impact of monetary policy on bank behavior. The result is that within the structure of the chosen model it is best for most European countries to include the discount rate together with the money market rate, because the first exerts statistical influence on bank behavior in addition to the information embodied in money market rate movements. Secondly we find that not accounting for changes in European monetary transmission over the last two decades and only estimating one single cointegration relationship ignores that the monetary transmission mechanism might have become more similar in the EU. This study argues that bank reaction to a money market rate shock has synchronised in the 1990s, not at impact but in the first three months after a monetary policy shock. This is even more pronounced when countries with similar financial structure are grouped accordingly. Starting with the nature of bank response and trying to form groups accordingly does not allow to form groups of economies with a similar financial structure. Last but not least we established that there is a significant impact of financial structure on monetary transmission, because factors such as the ratio of bank deposits to GDP or market capitalisation to GDP as well as the term structure have a statistically significant impact on the degree of interest rate pass-through by banks. Summing up we cannot reject any of the three hypotheses proposed in this paper.

Appendix

Data Description

Type	Label	Source	Range	Category
Austria				
Base Rate	d_{AT}	OENB	1M1980:9M2004	key rate
3-month interbank rate	m_{AT}	WIFO	1M1980:12M1998	market rate
new emissions rate	l_{AT}	WIFO	1M1980:12M2004	lending rate
industrial production	ip_{AT}	IFS	1M1980:12M2004	output
CPI	cpi_{AT}	IFS	1M1980:12M2004	inflation
Belgium				
discount rate	d_{BE}	IFS	1M1980:12M1998	key rate
t-bill rate	m_{BE}	IFS	1M1980:12M1998	market rate
lending rate (corporations)	l_{BE}	IFS	4M1985:9M2004	lending rate
industrial production	ip_{BE}	IFS	1M1980:12M2004	output
CPI	cpi_{BE}	IFS	1M1980:12M2004	inflation
Germany				
discount rate	d_{DE}	BuBa	4M1980:12M1998	key rate
3-m money market rate	m_{DE}	BuBa	1M1980:12M1998	market rate
lending rate (corporations)	l_{DE}	IFS	1M1980:6M2003	lending rate
industrial production	ip_{DE}	IFS	1M1980:08M2004	output
CPI	cpi_{DE}	IFS	1M1980:09M2004	inflation
Finland				
HELIBOR	d_{FI}	BoFi	4M1980:12M1998	key rate
3-m money market rate	m_{FI}	BoFi	12M1986:12M1998	market rate
lending rate (corporations)	l_{FI}	IFS	1M1980:6M2003	lending rate
industrial production	ip_{FI}	IFS	1M1980:08M2004	output
CPI	cpi_{FI}	IFS	1M1980:09M2004	inflation
France				
discount rate	d_{FR}	BDF	4M1984:12M1998	key rate
3-month interbank rate	m_{FR}	BDF	12M1986:12M1998	market rate
daily money market rate	$m1_{FR}$	BDF	1M1980:12M1998	market rate
lending rate (corporations)	l_{FR}	IFS	1M1980:9M2004	lending rate
industrial production	ip_{FR}	IFS	1M1980:08M2004	output
to be continued ...				

Type	Label	Source	Range	Category
CPI	cpi_{FR}	IFS	1M1980:09M2004	inflation
Ireland				
short term credit facility	d_{IE}	BoIre	1M1980:12M1998	key rate
3-m money market rate	m_{IE}	BoIre	1M1980:12M1998	market rate
lending rate (corporations)	l_{IE}	IFS	1M1980:9M2004	lending rate
industrial production	ip_{IE}	IFS	1M1980:08M2004	output
CPI	cpi_{IE}	IFS	1M1980:09M2004	inflation
Italy				
discount rate	d_{IT}	BI	1M1980:12M1998	key rate
3-m money market rate	m_{IT}	BI	1M1980:12M1998	market rate
lending rate (corporations)	l_{IT}	IFS	8M1983:2M2004	lending rate
industrial production	ip_{IT}	IFS	1M1980:08M2004	output
CPI	cpi_{IT}	IFS	1M1980:09M2004	inflation
Netherlands				
Call money market rate	d_{NL}	DNB	1M1980:12M1998	key rate
Aibor 3m	m_{NL}	DNB	1M1980:12M1996	market rate
lending rate (corporations)	l_{NL}	DNB	1M1980:10M2002	lending rate
industrial production	ip_{NL}	IFS	1M1980:08M2004	output
CPI	cpi_{NL}	IFS	1M1980:09M2004	inflation
Spain				
refinancing marginal rate	d_E	BEsp.	1M1980:9M2004	key rate
off. interbank reference rate	di_E	BEsp.	1M1980:9M2004	key rate
3 month interbanking rate	m_E	BEsp.	1M1980::9M2004	market rate
Lending rate (corporations)	l_E	IFS	1M1980:9M2004	lending rate
UK				
Monthly average of El. bills discount rate, 3 month	d_{UK}	BoE	1M1980:10M2004	key rate
t-bill rate	m_{UK}	IFS	1M1980:9M2004	market rate
lending rate	l_{UK}		1M2004:8M2004	lending rate
industrial production	ip_{UK}	IFS	1M1980:08M2004	output
CPI	cpi_{UK}	IFS	1M1980:09M2004	inflation
EMU Data				
main refinancing, fixed rate	d_{EMU}	ECB	1M1999:6M2000	key rate
to be continued ...				

Type	Label	Source	Range	Category
main refinancing, min. rate	d_{EMU}	ECB	6M2000:1M2005	key rate
EURIBOR, 3m	m_{EMU}	BuBa	1M1999:1M2005	market rate
fixed conversion rates	-	ECB	-	-

Table 2.5: Data Description

Variable	Range	Frequency	Source
market cap. to GDP	1988:2003	y	World Dev. Indicators
bank deposits	1980:2003	y	IFS database
bank credits	1980:2003	y	IFS database
private sector bank credits	1980:2003	y	IFS database
GDP	1980:2003	y	IFS database
gvt. bond yield	1M1980:12M2003	m	Datastream

Table 2.6: Panel Regression Data

Regression Specifications

Austria

$$\begin{aligned} \Delta l_{at,t} = & \alpha_0 + \alpha_1 \Delta l_{at,t-1} + \beta_0 \Delta d_{at,t} + \gamma_0 \Delta m_{at,t} + \gamma_1 \Delta d_{at,t-1} + \\ & \gamma_2 \Delta m_{at,t-2} + \gamma_3 \Delta m_{at,t-3} + \epsilon_t \end{aligned} \quad (2.10)$$

Belgium

$$\begin{aligned} \Delta l_{be,t} = & \alpha_0 + \alpha_1 \Delta l_{be,t-1} + \gamma_0 \Delta m_{be,t} + \gamma_1 \Delta d_{be,t-1} + \gamma_2 \Delta m_{be,t-2} + \\ & \gamma_5 \Delta m_{be,t-5} + \gamma_7 \Delta m_{be,t-7} + \gamma_8 \Delta m_{be,t-8} + \epsilon_t \end{aligned} \quad (2.11)$$

Germany

$$\begin{aligned} \Delta l_{de,t} = & \alpha_0 + \beta_0 \Delta d_{de,t} + \beta_2 \Delta d_{de,t-2} + \beta_3 \Delta d_{de,t-3} + \beta_4 \Delta d_{de,t-4} + \\ & \beta_5 \Delta d_{de,t-5} + \gamma_0 \Delta m_{de,t} + \epsilon_t \end{aligned} \quad (2.12)$$

Spain

$$\begin{aligned} \Delta l_{e,t} = & \alpha_0 + \alpha_1 \Delta l_{e,t-1} + \beta_0 \Delta d_{e,t} + \beta_1 \Delta d_{e,t-1} + \beta_3 \Delta d_{e,t-3} + \\ & \beta_4 \Delta d_{e,t-4} + \beta_5 \Delta d_{e,t-5} + \beta_7 \Delta d_{e,t-7} + \gamma_0 \Delta m_{e,t} + \gamma_4 \Delta m_{e,t-4} + \\ & \gamma_5 \Delta m_{e,t-5} + \gamma_6 \Delta m_{e,t-6} + \gamma_{10} \Delta m_{e,t-10} + \gamma_{11} \Delta m_{e,t-11} + \epsilon_t \end{aligned} \quad (2.13)$$

Finland

$$\Delta l_{fi,t} = \alpha_0 + \alpha_1 \Delta l_{fi,t-1} + \sum_{i=0}^5 \gamma_i \Delta m_{fi,t-i} + \epsilon_t \quad (2.14)$$

France

$$\Delta l_{f,t} = \alpha_0 + \alpha_1 \Delta l_{f,t-1} + \sum_{i=0}^{14} \gamma_i \Delta m_{f,t-i} + \epsilon_t \quad (2.15)$$

Ireland

$$\begin{aligned} \Delta l_{ie,t} = & \alpha_0 + \alpha_1 \Delta l_{ie,t-1} + \beta_0 \Delta d_{ie,t-0} + \beta_1 \Delta d_{ie,t-1} + \beta_3 \Delta d_{ie,t-3} + \\ & \beta_4 \Delta d_{ie,t-4} + \epsilon_t \end{aligned} \quad (2.16)$$

Italy

$$\Delta l_{it,t} = \alpha_0 + \alpha_1 \Delta l_{it,t-1} + \sum_{i=0}^2 \beta_i \Delta d_{it,t-i} + \gamma_0 \Delta m_{it,0} \epsilon_t \quad (2.17)$$

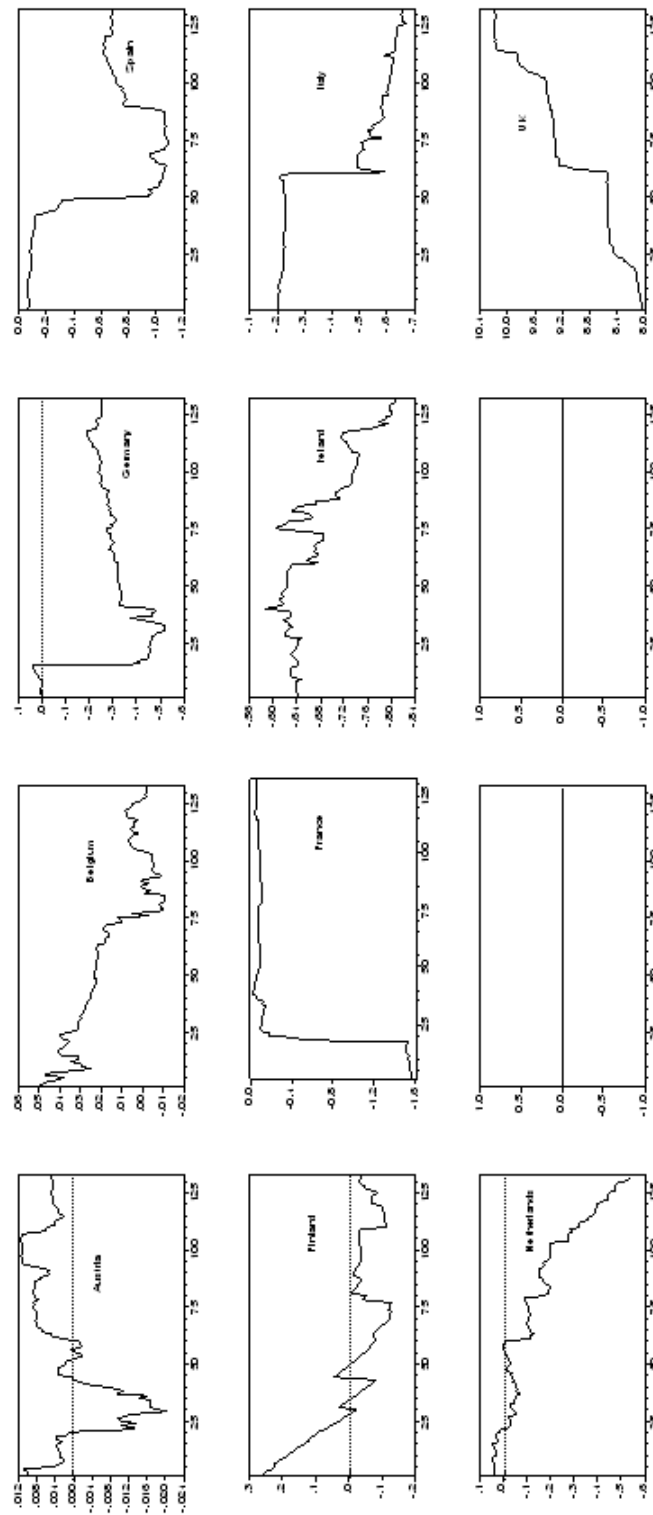
Netherlands

$$\Delta l_{nl,t} = \alpha_0 + \alpha_1 \Delta l_{nl,t-1} + \sum_{i=0}^6 \beta_i \Delta d_{nl,t-i} + \gamma_0 \Delta m_{nl,0} \epsilon_t \quad (2.18)$$

United Kingdom

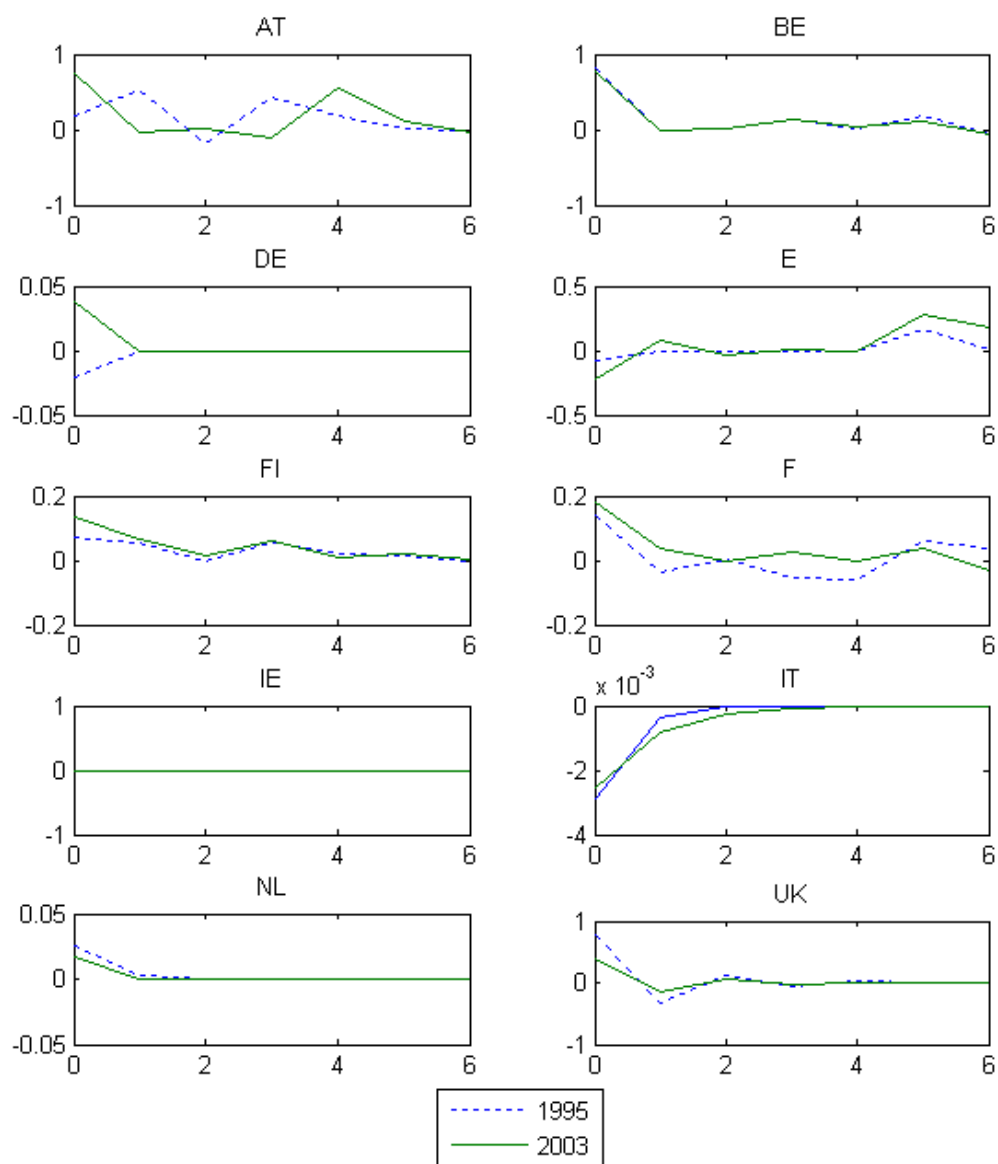
$$\Delta l_{uk,t} = \alpha_0 + \alpha_1 \Delta l_{uk,t-1} + \beta_1 \Delta d_{uk,t-1} + \beta_2 \Delta d_{uk,t-2} + \beta_6 \Delta d_{uk,t-6} + \beta_{10} \Delta d_{uk,t-10} + \gamma_0 \Delta m_{uk,t} + \epsilon_t \quad (2.19)$$

Regression and Test Statistics**Multiplier Models - Regression Statistics**



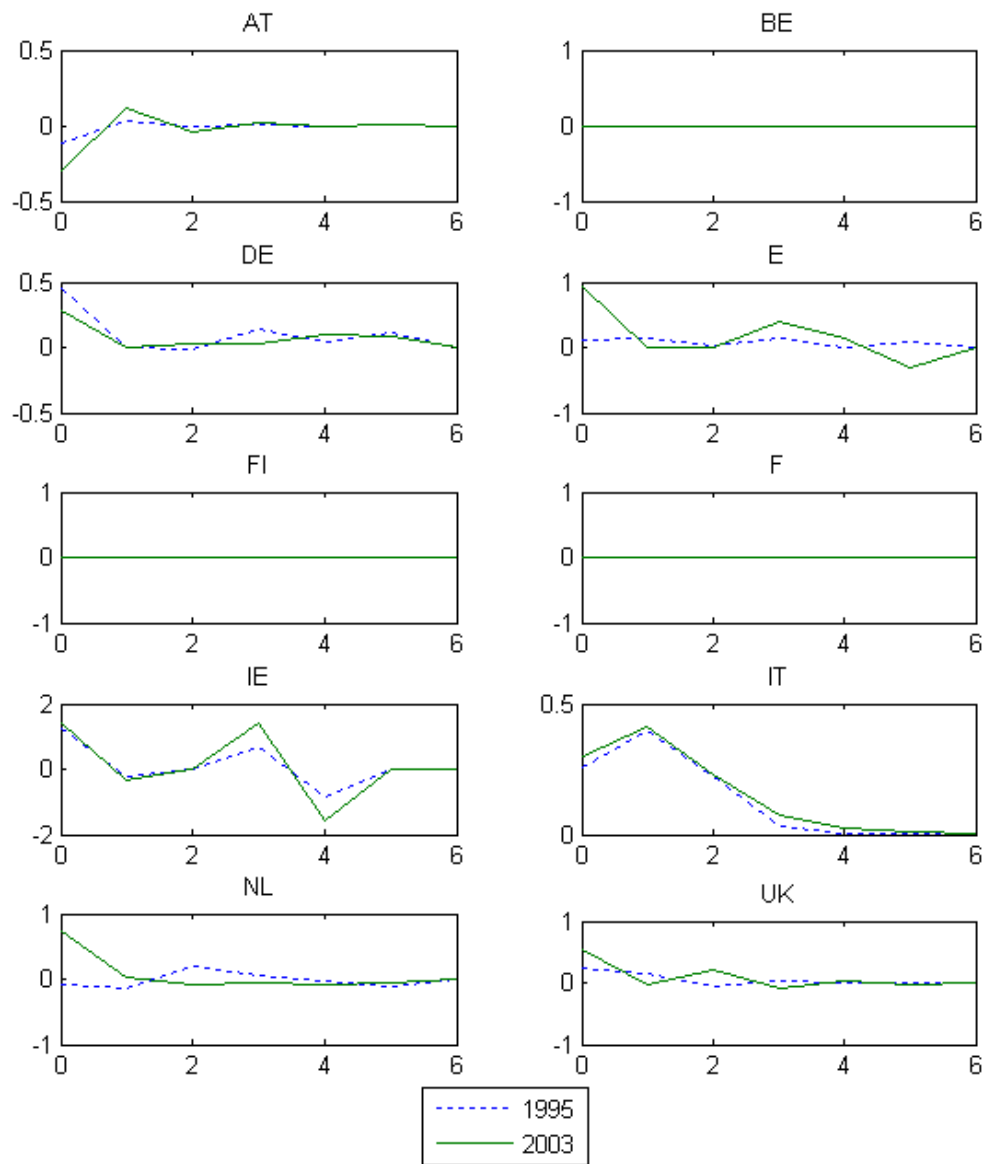
Source: own calculations.

Figure 2.5: Model selection by AIC



Source: own calculations.

Figure 2.6: Multipliers (money market rate)



Source: own calculations.

Figure 2.7: Multipliers (discount rate)

Residual Tests

As table 2.7 indicates we observe serial correlation in Germany, France, Finland and Italy indicating changes in the nature of the estimated relationship and that, when estimating the rolling regressions this autocorrelation disappears.

The regression residuals from France, Finland and Italy display heteroskedasticity. Thus, the rolling regressions are estimated as before, but the standard errors are calculated correcting for heteroskedasticity, which is due to White (1980) and computes the variance - covariance matrix the following way:

$$\hat{\Sigma} = \frac{T}{T-k} (X'X)^{-1} \left(\sum_{t=1}^T u_t^2 x_t x_t' \right) (X'X)^{-1}$$

where u_t are the OLS residuals, T is the sample size and X is a $T \times k$ matrix of regressors.

	Breusch-Godfrey Serial Correlation LM Test			White Heteroscedasticity Test			Normality Test	
	F-statistic	Prob.	Obs. * R ²	F-statistic	Prob.	Obs. * R ²	Jarque-Bera	Prob.
Austria	16.88	0.00	44.52	1.77	0.05	20.70	381	0
Belgium	3.68	0.00	28.23	3.58	0.00	63.23	50	0
Germany	1.56	0.16	9.57	3.17	0.00	50.14	6630	0
Spain	1.74	0.06	22.62	7.65	0.00	171.04	1649	0
France	0.81	0.45	1.64	0.30	0.94	1.82	5539	0
Finland	0.33	0.94	2.55	1.36	0.15	26.36	391	0
Ireland	12.27	0.00	43.56	65.64	0.00	224.37	15941	0
Italy	1.29	0.28	2.64	0.15	1.00	1.58	90437	0
Netherlands	2.75	0.01	16.45	10.14	0.00	116.73	727	0
UK	3.42	0.00	39.20	10.19	0.00	155.11	2539	0

Source: own estimation.

Table 2.7: Residual Tests

Panel Regression Tests

Table 2.8: Variable description

Variable	Description	Calculation
MC	market capitalisation as a share of GDP	obt. from the DB (7 yr. ma*)
bd	bank deposits to GDP	obt. from the DB (7 yr. ma*)
bpuc	public bank loans to GDP (total loans - private loans)	obt. from the DB (7 yr. ma*)
bpc	bank credits to GDP (excl. public loans)	obt. from the DB (7 yr. ma*)
inf	last year's inflation (1994, . . . , 2003)	
ys	spread between government bonds and 3-month mmr rates	return (gvt. bonds) - mmrate
vola	volatility of the money market	s.e. of fitted ARMA processes from the mmr (2yr. ma*)

Notes: * ma = moving average

Table 2.9: Poolability Tests

	pooled	one-way	two-way
rss	2.2054	0.29442	0.22998
df	7	64	55
	Fstat.	Fcrit	dffcrit
ols vs 1w	59.3431735	2.15	(n-1,nt-n-k)
ols vs 2w	67.48916055	2.18	(n-1,nt-n-t-k+1)
1w vs 2w	0.240795395	1.54	(nt-n-k,nt-n-t-k+1)

Source: own estimation.

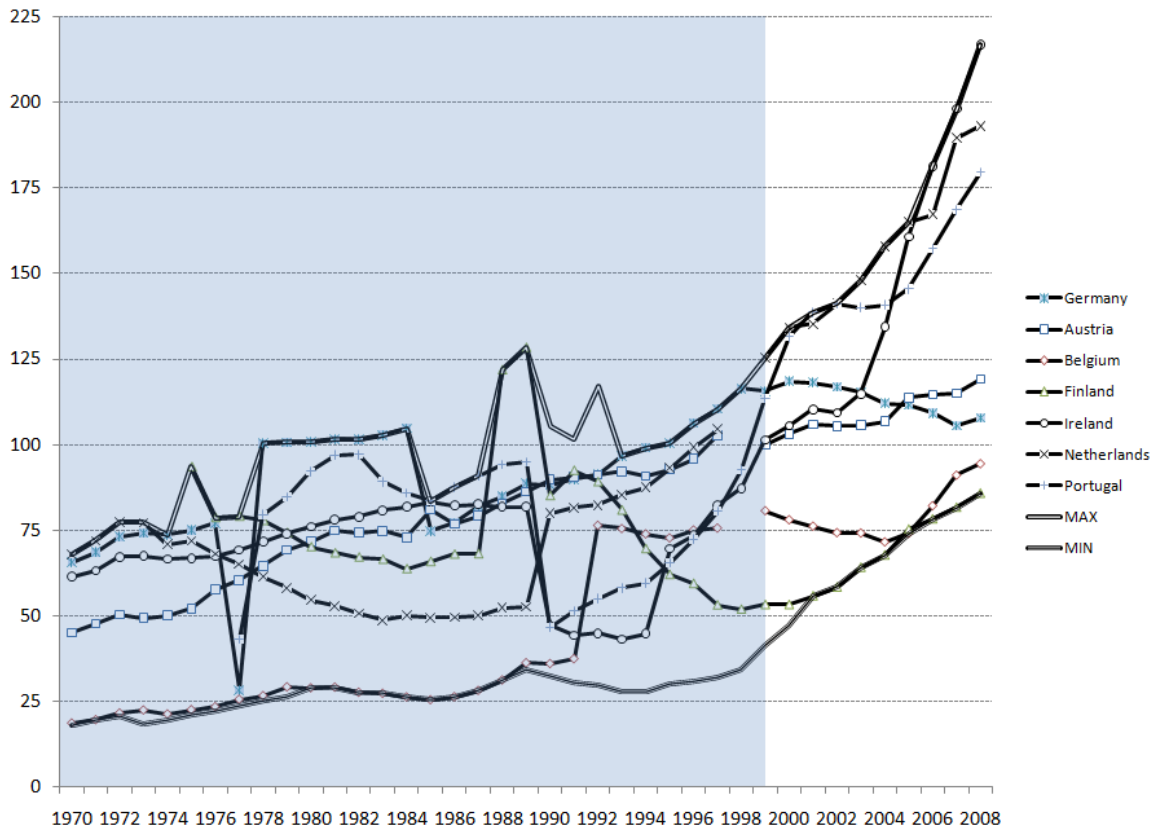
Chapter 3

Aggregate Investment Behaviour, Bank Behaviour and the monetary transmission mechanism in small EMU members

3.1 Introduction

In some member economies of the euro area (EA) we can observe a major break in the ratio of credit to the private sector to GDP, normally used to assess the importance of banks in an economy, between 1995 and 1998. Figure 3.1 plots the ratio for small EA members between 1970 and 2009. Until the mid-90s most later EMU members experienced a stable credit to GDP ratio. Starting two years before the introduction of the common currency the Irish, Portuguese and Dutch credit to GDP ratio started to increase strongly and doubled until 2008. The credit to GDP ratio in other small EA member economies (Austria, Belgium and Finland) remained stable until 2009. Since all the small economies had the same currency, different monetary policy objectives cannot serve as an explanation, a possible explanation is that the common monetary policy had different impacts on credit in the EA member economies.

This different impact of monetary policy on credit markets in small EA members could either arise from the supply side or different aggregate demand elasticities in these economies. As credit is mainly transmitted through national banking systems, bank behaviour, most importantly the different degree of pass-through of monetary policy impulses, might be one source of variation across EA member states on the supply side. On the demand side, different investment elasticities might cause the credit volume to react differently to common monetary policy across economies in the EA. This article tries to disentangle demand and supply effects in the transmission of monetary policy through credit markets of small EA members. Focusing on small EMU members has the benefit that we do not have to account additionally for structural changes in the EA monetary transmission mechanism, as every small EA member will only have a negligible impact on the EA as a whole. Instead we can focus on deviations



Notes: The shaded area represents the time before the introduction of the euro.
 Source: World Bank Indicator Database.

Figure 3.1: Credit to the private sector in relation to GDP

from the EA as a whole.

Cyclical developments in small open economies will normally be driven by world developments and developments in its main trading partners. This especially applies to small open economies in the European monetary union. Prior to the establishment of the currency union macroeconomic policies in these economies depended on policies in larger EU economies, most importantly Germany and France. This was primarily important for monetary policy, as most later EMU members had to tie their currencies to the DM to ensure a credible commitment to the European Monetary System (EMS). In contrast to small open economies, monetary policy authorities in the four large economies in the EA of today were less restricted by a commitment to the EMS. Ciccarelli & Rebucci (2006) show that monetary policy authorities in Spain and Italy and, to a lesser extent, in France, were less committed to the goal of price stability than the anchor central bank of the EMS, the German Bundesbank. For small open economies in the EA we would expect that already prior to the introduction of the common currency common cyclical movements will have played a major role for the components of GDP that either depend directly on foreign demand such as exports or indirectly such as investment, depending on interest rates movements determined outside the small open economies.

The introduction of a common currency nevertheless represents a major step to further

synchronisation of cycles as transaction costs of export decrease due to elimination of exchange rate risks. Furthermore the synchronisation of national commercial law codes preceding the introduction of the common currency is likely to have changed national banking markets leading to an increase in contestability and competition and therefore change bank behaviour, which might trigger considerable structural changes in favour of synchronisation. Mojon (2000) for instance provided evidence that competition among banks can lead to a more synchronous interest pass-through. Bank reaction to monetary policy in Europe has recently been studied in a number of papers. (compare Mojon 2000, De Bondt 2005, De Bondt, Mojon & Valla 2005) Overall there is evidence that the response of retail bank interest rates to monetary policy interest rates is rather sluggish and only complete after some time in countries of the EA. In theory there are reasons to doubt whether banks will in general immediately pass on interest rate increases by the central bank to firms completely. Stiglitz (1999) presents a model of imperfect information studying bank behaviour in the transmission of monetary policy. He demonstrates that banks can be reluctant to react to monetary policy impulses due to their risk perception and net worth. This is because banks incorporate the endogenous risk of default of their creditors in reacting to monetary policy.

Studies looking at business cycle synchronisation yield ambiguous results. Eickmeier & Breitung (2006) observe a lower business cycle correlation for output and inflation for some peripheral EA member states (Greece and Portugal) with the EA core than between the EA core and new EU member states which are not EA members. Their analysis further suggests that output and inflation linkages have not changed in the initial five years after the adoption of the euro between member states. EA wide movements seem to explain movements in inflation and output in the individual member states only to varying degrees. One problem associated with this strand of the literature is that these articles look at total output and not at its components that are more directly and thus more quickly influenced by structural change and therefore more likely to be synchronised earlier after the introduction such as bank behaviour and investment. This paper aims at filling this apparent gap. It focuses on disentangling the effects of monetary policy on real investment in two distinct parts, bank behaviour and investment behaviour.

Investment behaviour will primarily depend on the user cost of capital. The user cost of capital is determined by the real interest rate in the economy. The real interest rate faced by a company considering to undertake investment will depend on nominal interest rates set by the central bank, inflationary expectations of all agents in the economy and commercial bank behaviour. In the course of introducing the common currency the first two determinants of real interest rates are likely to synchronise as in the beginning of the euro 11 central banks were replaced by one central bank committed to price stability. Apart from that the user cost of capital will also depend on legal constraints governing the tax treatment of the different forms of investment financing. In the light of the synchronisation of tax codes prior to and after the introduction of the common currency this source of variation is likely to vanish even though the structures of the tax system within the EU area still exhibit considerable differences. Investment demand in small open economies will further depend on external developments, as these govern export demand which will influence investment demand. Furthermore to the

extent that the domestic business cycle of the small open economy is not entirely synchronised with the business cycle of the larger currency union, developments in the domestic economy will to some extent influence investment demand, as will be explained in the following section in more detail. Summarising, it is not entirely clear which of the factors briefly sketched above mainly drive aggregate investment in small open economies of the currency area.

This paper is related to the literature on credit effects in the monetary transmission mechanism in a macroeconomic setting including theoretical as well as empirical contributions on the credit and bank lending channels in the monetary policy transmission. The seminal paper on the balance sheet channel of monetary policy was by Bernanke & Gertler (1989), Bernanke & Blinder (1988) provide the seminal theoretical treatment of the bank lending channel. How monetary policy affects credit conditions by banks was studied in an US context by Lown & Morgan (2002). Kaufmann & Valderrama (2008) and Eickmeier, Hofmann & Worms (2009) investigate the effects of macroeconomic fluctuations for the UK and Germany and Germany and the EA respectively.

In addition this paper also draws on insights of the literature on the interest rate pass-through of monetary impulses indicating that changes in the monetary policy rate have not been instantaneously and sometimes not completely transmitted to retail banking interest rates, even though there is evidence that the instantaneous transmission has accelerated after the introduction of the euro. This was found for the EA as a whole in the article by De Bondt (2005). Mojon (2000) finds that in the pre-euro era interest rate pass-through of monetary policy rate changes was different across member countries in the EA. Further, De Bondt et al. (2005) confirm the results on the sluggish adjustment to monetary policy rates for all EA member economies and find that, even though the pass-through has accelerated after the introduction of the euro, significant differences remain across countries.

This paper contributes to the literature in two ways. First it extends the standard SVAR models to study the transmission of monetary policy to the real economy (e.g. Peersman & Smets 2001, Mojon & Peersman 2001, Ehrmann 1998)¹ incorporating bank behaviour and stock market developments. Secondly it provides a framework to disentangle the transmission of monetary policy effects on real investment in members of the EA in bank behaviour and investment behaviour using the post 1999 sample only. Updating the results of the monetary transmission framework at the ECB (e.g. Peersman & Smets 2001, Mojon & Peersman 2001) was also recently suggested by the OECD (2009) in the report on the EA.

This paper is organised as follows. Section 3.2 discusses the channels through which monetary policy affects investment behaviour. Section 3.3 follows with a discussion of interest rate pass-through in the banking sector and discusses possible implications of the introduction of the euro on the bank pass-through. Section 3.4 presents the empirical framework to analyse the effects of monetary policy on investment and GDP in small EMU members and provides a test framework for differences in bank behaviour and investment sensitivity across EMU members. Section 3.5 presents the results, section 3.6 concludes.

¹see also BIS (1994), Locarno et al. (2001), Cecchetti (1999), Ciccarelli & Rebucci (2002), Clausen & Hayo (2002), Ehrmann et al. (2003)

3.2 The effects of monetary policy on investment

Empirical studies on the monetary transmission mechanism often find relatively large and long lasting effects of monetary policy on real economic activity. These characteristics can however not be entirely explained by a change in the cost of capital, which is likely to occur immediately after the monetary policy intervention. This observation motivated the view that credit markets will play an important role in the transmission process.

The so-called credit channel of monetary policy is due to the imperfect information between lenders and borrowers, which leads to credit frictions. As a consequence there is a gap between the opportunity cost of using internally generated funds and externally obtainable funds for investment, the external finance premium. Proponents of the credit view argue that monetary policy will influence the external finance premium in two ways, through the balance sheet of firms and bank lending. (Bernanke & Gertler 1995)

The idea of the balance sheet channel is that a tightening of monetary policy will affect the borrowers' financial position or net worth, which is the sum of liquid assets and collateral. (compare for instance Bernanke & Gertler 1989) The stronger a borrower's financial position, the smaller the potential conflicts of interest with the lender, the smaller the external finance premium. Fluctuations in financial wealth will thus affect firms' spending and investment decisions. Monetary policy can affect the financial position in 3 ways. A direct effect will be that due to the outstanding debt the borrower has, an increase in interest rates will raise interest expenditure. Secondly, as rising interest rates are normally associated with declining asset values, the borrowers' balance sheets will be weakened. A more indirect effect is that increases in interest rates will induce a borrowers' customers to decrease their spending, which will depress the borrowers' revenues and thus over time will decrease borrowers' net worth and probably creditworthiness. (Bernanke & Gertler 1995)

The bank lending channel focuses on the role of banks in the transmission of monetary policy. (e.g. Bernanke & Blinder 1988) This channel recognizes banks as the dominant source of external finance. If the central bank increases its policy interest rate, increases in the costs of funds for banks will lead to a decrease of the volume of credit supplied to the economy and therefore raise interest rates at which firms can obtain credit. By how much the lending rate increases will depend on several factors, namely competition in the banking system, considerations of banks about how the risk of default of their customers is affected as well as bank behaviour in general.

Monetary policy will further affect real investment spending by changing the real interest rate (r_r) and expectations about future economic activity. Due to wage and price stickiness a change in the central bank's key nominal interest will affect their nominal lending rates and finally the real interest rate companies face, or,

$$r_{ecb} \uparrow \rightarrow r_l \uparrow \rightarrow r_r \uparrow \rightarrow I \downarrow$$

Because of the balance sheet channel the net worth of borrowers will be altered by mone-

tary policy decisions, as indicated above, or,

$$r_{ecb} \uparrow \rightarrow p_{assets} \downarrow \rightarrow \text{net worth} \downarrow \rightarrow r_l \uparrow \rightarrow I \downarrow$$

Apart from that, investment behaviour will depend on expectations about the future economic development. In his famous article Tobin (1969) introduced a concept later named after him, *Tobin's q*. The underlying idea behind Tobin's q is that a firm compares the total expected revenue stream generated by the project with the cost of the investment. If the value of future revenues is greater than the cost of investment the project is worth undertaking. Assuming that stock market developments reflect all available information at a given point in time, we can infer that the stock market value of firms is equal to the present value of expected value of future of future profits. As in practice *marginal q* is hard to measure, empirical studies used a related idea, *average q*. Average q can be approximated by the total market value of the firm divided by the replacement cost of its capital. Therefore we would expect a negative effect of interest rates on investment, as an increase in interest rates is associated with a decrease in stock market returns. (compare Caballero 1999, Taylor 1999) Furthermore if q is high, the market value of firms relative to the cost of capital is high and thus new capital goods are cheap relative to the market value of the firm. (Mishkin 1995) To summarise,

$$\begin{aligned} r_l \uparrow &\rightarrow q \downarrow \rightarrow I \downarrow \\ p_{assets} \uparrow &\rightarrow q \uparrow \rightarrow I \uparrow \end{aligned}$$

Another approximation to empirically include expectations inherently in the investment decision process is to take into account capacity utilisation. To approximate this, the business cycle measured in terms of past changes in real GDP (y_{t-p}) will influence investment decisions, or

$$y_{t-p} \uparrow \rightarrow \text{capacity utilization} \uparrow \rightarrow I \uparrow$$

3.3 Monetary policy and bank behaviour

The credit view of monetary policy transmission sketched above emphasizes the special role of banks. Bank behaviour was so far analysed in isolation, most papers concentrated on the pass-through of monetary policy impulses. Empirical studies of the interest rate pass-through have shown that interest rates are not instantaneously and completely transmitted. De Bondt (2005) investigates the interest rate pass-through for the EA and finds that the initial pass-through of interest rate prior to the introduction of the common currency is typically 50% initially and it takes up to three years that money market interest rate increases are fully incorporated in bank lending interest rates. After the introduction of the common currency the initial pass-through of interest rates appears to have increased, and also the speed at which banks pass on their increased cost of capital to their customers increased. He explains this change by an increase in competition in the European banking market after the introduction

of the euro. Competition is hard to measure, there is however some indication that competition increased. Cross-border interbank lending activity has increased considerably since the introduction of the common currency. Also cross-border retail lending activity has increased. It is however still at a low level compared to interbank lending. (compare OECD 2009)

Competition is certainly a factor that might influence banks' decision to pass on interest rates to their borrowers to different degrees. Another explanation was provided by Stiglitz (1999), showing that banks, because they incorporate their borrowers' risk of default in a situation where credit is tightened into their decisions, may be reluctant to pass on increases in interest rates due to effects tighter monetary policy has on their borrowers' financial position. Thus Stiglitz's argument would indicate that

$$r_{ecb} \uparrow \rightarrow r_l \uparrow \rightarrow GDP \downarrow \rightarrow \text{risk of default} \uparrow \rightarrow r_l$$

Another reason why banks might not pass on monetary impulses completely in the beginning is that money market volatility plays a role for the degree of interest pass-through. Because of the increase in integration in European interbank markets (compare OECD 2009), banks in small open economies are likely to benefit from the integration into a larger currency area via the access to a deeper interbank market with a lower volatility.

Kaufmann & Valderrama (2008) and Eickmeier et al. (2009) investigate the effects of macroeconomic fluctuations on bank behaviour in the UK and Germany and Germany and the EA respectively. Whereas Eickmeier et al. (2009) find no indication of amplifying effects of credit market frictions in the transmission of monetary policy, Kaufmann & Valderrama (2008) find evidence for procyclical effects in lending. Furthermore they find cross country differences in lending in response to real shocks to the economy. This suggests that bank behaviour might have changed due to the introduction of the common currency, which might lead to a higher integration of markets through increases in intra-EA trade (as suggested by Rose 2000, Rose 2001). As a consequence we might observe a higher business cycle correlation in the EA. Evidence from the first five years of the euro, however, seems to suggest that correlations were not higher for all EMU members. Eickmeier & Breitung (2006) find that Portugal and Greece displayed a lower degree of business cycle correlations with the EA core than some eastern European EU members that are not members of the EA.

It is therefore not clear whether establishing a monetary union will lead to a more similar bank behaviour in small members of the EA.

3.4 The empirical framework

To model the various determinants for investment and bank behaviour we consider the following structural VAR model:

$$y_t = A(L)y_t + Dx_t + Bv_t, \tag{3.1}$$

where y_t is a vector of endogenous variables, $A(L)$ is a lag matrix polynomial, D and B are coefficient matrices, x_t is a matrix of exogenous variables and ν_t is a vector of idiosyncratic shocks. The structure of the coefficient matrices and variable vectors is given by

$$y = \begin{pmatrix} \Delta y_{ea,t} \\ \pi_{ea,t} \\ r_{ecb,t} \\ \Delta y_{i,t} - \Delta y_{ea,t} \\ r_{l,t} - r_{ecb,t} \\ r_{sm,t} \\ \Delta i_{i,t} - \Delta y_{i,t} \end{pmatrix}, B = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{21} & b_{22} & 0 & 0 & 0 & 0 & 0 \\ b_{31} & b_{32} & b_{33} & 0 & 0 & 0 & 0 \\ b_{41} & 0 & 0 & b_{44} & 0 & 0 & 0 \\ b_{51} & 0 & b_{53} & b_{54} & b_{55} & 0 & b_{57} \\ b_{61} & b_{62} & b_{63} & b_{64} & b_{65} & b_{66} & b_{67} \\ b_{71} & 0 & 0 & b_{74} & 0 & 0 & b_{77} \end{bmatrix}, D = \begin{bmatrix} d_{11} & 0 & d_{13} \\ 0 & d_{22} & d_{23} \\ 0 & d_{32} & d_{33} \\ d_{41} & 0 & d_{43} \\ d_{51} & 0 & d_{53} \\ 0 & d_{62} & d_{63} \\ d_{71} & 0 & d_{73} \end{bmatrix}$$

$$x_t = (\Delta y_{us,t}, \pi_{oil,t}, 1), A(L) = \begin{bmatrix} A_{ea}(L) & 0 \\ A_1(L) & A_2(L) \end{bmatrix}, A_1(L) = \begin{bmatrix} a_{41} & 0 & 0 \\ a_{51} & 0 & a_{53} \\ a_{61} & a_{62} & a_{63} \\ a_{71} & 0 & 0 \end{bmatrix}$$

The first three equations of every country-system describe a small-scale monetary model of the EA, where the first equation explains the changes in EA real GDP as a function of innovations to EA real GDP and past movements of EA real GDP, EA inflation, and a short term money market rate.

The second equation can be interpreted as a Phillips-curve, which describes EA inflation as a function of past movements of EA real GDP, EA inflation and a short term money market rate as well as contemporaneous innovations to EA real GDP and to the inflation rate.

The third equation describes the short term EA interest rate as a function of current innovations to EA real GDP, EA inflation, and the interest rate as well as of past movements of EA real GDP, EA inflation and a short term money market rate. It can be considered a monetary reaction function.

The last four equations focus on deviations from EA variables. The fourth equation describes the deviations of country-level real GDP from EA real GDP as a function of current and past real EA GDP, its own lags, past innovations to the spread between national lending rates and the EA interbank rate, stock market returns, and deviations of real investment growth from national GDP growth. Furthermore changes in real GDP area also depend on current US real GDP growth as well as an idiosyncratic shock to the economy's real GDP growth deviating from EA GDP growth.

The fifth equation describes the economy's lending rate spread to the EA interbank interest rate as a function of past EA inflation in order to capture differences in area-wide inflationary expectations by the economy's banks. Current and past deviations of national GDP from EA GDP growth, current and past national EA GDP shocks and current and past deviations of national real investment growth from national GDP growth to proxy for credit demand at the national and EA level. The bank lending rate spread is further a function of the EA short term rate which is driven by monetary innovations of the ECB, as banks obtain funds on the

European interbank market. As indicated above banks' decision to alter lending rates will also depend on stock market returns, which enter the bank lending rate equation in a lagged way. This equation will be discussed in section 3.4.1 in further detail.

The economy's stock market returns will react to all variables simultaneously as well as to past innovations of all variables.

Deviations of real investment from real GDP growth will depend on current and past innovations of EA real GDP and current US GDP as a proxy for international demand movements. It furthermore depends on past national real GDP growth for reasons outlined above. As expectations about future economic activity are especially important for investment decisions we include past stock market index changes in this equation. Furthermore, because of the credit channel, we also include current innovations to lending rate spreads as well as past movements of lending rate spreads in the equation. For a further discussion see section 3.4.2.

The vector ν_t represents current innovations to the system in equation (3.1). The first shock (ν_1) is allowed to affect all variables of the system simultaneously and is interpreted as an EA-wide aggregate demand shock. Shock ν_2 only affects EA-wide inflation, the interbank rate and the change in the national stock market index and is interpreted as an EA inflation shock. The third shock affects the EA interbank rate, the spread between bank lending and interbank interest rates as well as the change in the stock market index. This will be interpreted as a monetary policy shock.

The second set of shocks ($\nu_4 - \nu_7$) are shocks that only affect national variables simultaneously. This is done to account for different degrees of business cycle correlations, different bank behaviour as well as different degrees of stock market integration between members of the EA. ν_4 affects all national variables simultaneously and is therefore interpreted as a national AD shock. ν_5 affects the spread between bank lending rates and changes in stock market returns and is interpreted as a shock to bank behaviour that is not related to the monetary policy shock. ν_6 is a shock to the economy's stock market that is not related to any other shock in the system. Finally ν_7 is a shock to the economy's investment that simultaneously affects bank lending rate spreads as well as changes to national stock market indices.

3.4.1 Bank Behaviour

The interest rate pass-through is modeled by equation (5) of the system given in (3.1). More explicitly this equation is given by

$$\begin{aligned}
r_{l,t} - r_{ecb,t} &= \sum_{j=1}^p \alpha_{53,j} r_{ecb,t-j} + b_{53} \nu_{3,t} + \sum_{j=1}^p \alpha_{55,j} (r_{l,t-j} - r_{ecb,t-j}) + b_{55} \nu_{5,t} + \dots \\
\dots &+ \sum_{j=1}^p \alpha_{51,j} \Delta y_{ea,t-j} + b_{51} \nu_{1,t} + \sum_{j=1}^p \alpha_{54,j} (\Delta y_{i,t-j} - \Delta y_{ea,t-j}) + b_{54} \nu_{4,t} + \dots \\
\dots &+ \sum_{j=1}^p \alpha_{57,j} (\Delta i_{i,t-j} - \Delta y_{i,t-j}) + b_{57} \nu_{7,t} + \sum_{j=1}^p \alpha_{56,j} r_{sm,t-j} + b_{56} \nu_{6,t} + \dots \\
\dots &+ d_{51} \Delta y_{us,t} + d_{53}.
\end{aligned}$$

The spread between bank lending rates and EA interbank rates ($r_{l,t} - r_{ecb,t}$) therefore depends on shocks to the interbank interest rate as determined by the ECB, past changes in interbank rates as well as shocks to the spread between interbank and bank lending rates and the past evolution of this spread. This is a more general formulation of the interest pass-through than in models by Cottarelli & Kourelis (1994), Mojon (2000), De Bondt (2005) and De Bondt et al. (2005). These papers formulate interest pass-through models either as VECM models using the interbank and bank retail rates or as simple single equation models either that use cointegration techniques or estimating the models in differences. It is however questionable whether cointegration techniques will yield important insights in a period of structural change in the banking sector over the last 15 years. It furthermore ignores useful information stemming from the transition of one monetary policy regime to another, i.e. the transition from one steady state of a small open economy to another. Furthermore the order of integration of interest rates is not clear from an economic point of view. Looking at the spread between bank lending and interbank interest rates on the basis of a single equation assumes that interbank rates will not change due to changing macroeconomic conditions, hence it assumes that the interbank rate stays constant after the change. This is a special case of equation (3.2), which is however not very likely to occur, therefore the actual interest rate pass-through might be different to the results suggested by Mojon (2000), De Bondt (2005) and De Bondt et al. (2005).

The formulation of the equation above is slightly more general for another reason than classical models of the interest rate pass-through, as the time-varying spread between interbank and bank retail rates furthermore depends on EA AD shocks ($\nu_{1,t}$), on national AD shocks ($\nu_{4,t}$), which are independent of EA AD shocks and idiosyncratic national AD shocks, as well as past movements in EA GDP and deviations of national GDP from EA GDP movements. The second line in equation (3.2) accounts for other national sources of innovation, current idiosyncratic investment shocks ($\nu_{7,t}$), past deviations of investment growth rates from national GDP growth rates, as well as current stock market innovations ($\nu_{6,t}$) and past movements in quarterly stock market returns. The last line in equation (3.2) accounts for exogenous disturbances by including US output movements.

If banks pass on monetary policy rates completely and instantaneously, we would not expect $r_{l,t} - r_{ecb,t}$ to be significantly different from zero. The time length of the difference in the spread from zero will therefore measure the time banks take to pass-through interest rate impulses by the central bank.

3.4.2 Differences in monetary policy effects on aggregate investment and GDP

If banks passed-through monetary policy impulses completely and symmetrically, asymmetries in transmission of monetary policy monetary policy impulses might still arise from different interest sensitivities of output and investment, i.e. from aggregate demand (either total or investment demand). This cannot, however, fully be assessed in the current framework as the interest pass-through is most likely not symmetric and complete. We can nevertheless obtain

some insights from the effects of monetary policy on national investment and GDP. Equation (4) in the equation system in (3.1) measures the effects of monetary policy on national output in comparison to EA GDP,

$$\begin{aligned}
\Delta y_{i,t} - \Delta y_{ea,t} &= \sum_{j=1}^p \alpha_{41,j} \Delta y_{ea,t-j} + b_{41} \nu_{1,t} + \sum_{j=1}^p \alpha_{44,j} (\Delta y_{i,t-j} - \Delta y_{ea,t-j}) + b_{44} \nu_{4,t} + \dots \\
\dots &+ \sum_{j=1}^p \alpha_{45,j} (r_{l,t-j} - r_{ecb,t-j}) + \sum_{j=1}^p \alpha_{46,j} r_{sm,t-j} + \dots \\
\dots &+ \sum_{j=1}^p \alpha_{47,j} (\Delta i_{i,t-j} - \Delta y_{i,t-j}) + d_{41} \Delta y_{us,t} + d_{43}.
\end{aligned}$$

Deviations of national from EA growth rates are explained by an EA AD shock and an idiosyncratic shock to the economy's GDP growth differential as well as past movements in EA GDP growth and the national-EA growth differential. Monetary policy affects the economy's GDP differential with respect to the EA through the above discussed spread between bank lending rates and interbank rates. Furthermore lagged investment deviations and lagged quarterly stock market returns affect the economy's growth differential with respect to the EA. If monetary policy does not affect national GDP differently than EA GDP, $\Delta y_{i,t} - \Delta y_{ea,t}$ will not be different from zero. Assuming for the moment that the interest rate pass-through of monetary policy impulses is instantaneous, complete and symmetric the response of $\Delta y_{i,t} - \Delta y_{ea,t}$ to monetary policy shocks could then be interpreted as a difference in interest rate sensitivities of national and EA outputs.

The last equation of system (3.1) models deviations of national real investment growth from national output growth in a similar way,

$$\begin{aligned}
\Delta i_{i,t} - \Delta y_{i,t} &= \sum_{j=1}^p \alpha_{71,j} \Delta y_{ea,t-j} + b_{71} \nu_{1,t} + \sum_{j=1}^p \alpha_{74,j} (\Delta y_{i,t-j} - \Delta y_{ea,t-j}) + b_{74} \nu_{4,t} + \dots \\
\dots &+ \sum_{j=1}^p \alpha_{75,j} (r_{l,t-j} - r_{ecb,t-j}) + \sum_{j=1}^p \alpha_{76,j} r_{sm,t-j} + \dots \\
\dots &+ \sum_{j=1}^p \alpha_{77,j} (\Delta i_{i,t-j} - \Delta y_{i,t-j}) + b_{77} \nu_{7,t} + d_{71} \Delta y_{us,t} + d_{73}, \tag{3.2}
\end{aligned}$$

except that the idiosyncratic investment shock ($\nu_{7,t}$) is included.

Assuming that the bank pass-through is complete, instantaneous and symmetric and that the reaction of national GDP is the same as EA GDP, the reaction of investment to monetary policy shocks measures differences in interest rate sensitivities of investment and GDP in the respective economy. If $\Delta i_{i,t} - \Delta y_{i,t}$ is not significantly different from zero at all points of the response function to the monetary policy impulse, then interest rate sensitivities of investment and output are the same implying symmetric effects of the common monetary policy.

3.5 Results

3.5.1 Data

The model described in the previous subsection was estimated for the period 1999:1 - 2009:4. Data for real GDP, real investment and harmonised consumer price indices were obtained from the OECD's economic outlook database. The EURIBOR3M interest rate was used to approximate the EA short term money market rate. Lending rates were obtained from the IFS database. However most general lending rates were published only until the end of 2003. From 2003 onwards we continued the series with the quarterly change in the average of all published and more detailed lending rates. Details can be found in tables 3.2 and 3.3 in appendix 3.6. Stock market indices were taken from the Thompson datastream database. Details on the indices used can be found in the appendix. Interest rates enter in levels, all other variables enter in quarter-on-quarter changes in logs.

All country models were estimated using a FGLS estimator, we tested the inclusion of more than one lag by AIC (up to two lags²). Lag lengths³ of the models are provided in table 3.4 in the appendix.

3.5.2 Effects of monetary policy in the euro area

Figure 3.8 in the appendix displays the impulse response functions of the EA submodel defined by the first three equations in (3.1).

The first column of graphs in the figure displays the reaction of EA inflation and the European 3 months interbank rate to an unanticipated EA-wide AD shock. The increase in aggregate demand exerts inflationary pressures that lead to an increase in inflation, which is however not significant. This can be attributed to the increase in the monetary policy determined 3 month money market rate which slows down aggregate demand and thus inflationary pressures decrease again.

The second column of graphs displays the effects of an unanticipated increase in inflation which leads to an increase in the monetary policy determined interest rate that drives down aggregate demand, leading to a decrease in inflation.

shock	Magnitude	GDP		Inflation		Interest rate	
ν_1	0.41	0.7*	3	0.19	3	0.42*	4
ν_2	1.06	-0.2	8	1.06*	0	0.06	3
ν_3	0.24	-0.5*	8	-0.12*	5	0.24*	0

Source: own estimation.

Table 3.1: EA: Maximal Effects of EA shocks

The third column shows the effects of an unanticipated monetary policy shock, which

²We restricted the maximal number of possible lags to two in each equation system, as in some equations the number of parameters is large and given the chosen sample size (48 quarters) the degrees of freedom are already low. A more detailed description of the choice of lags can be found in the appendix.

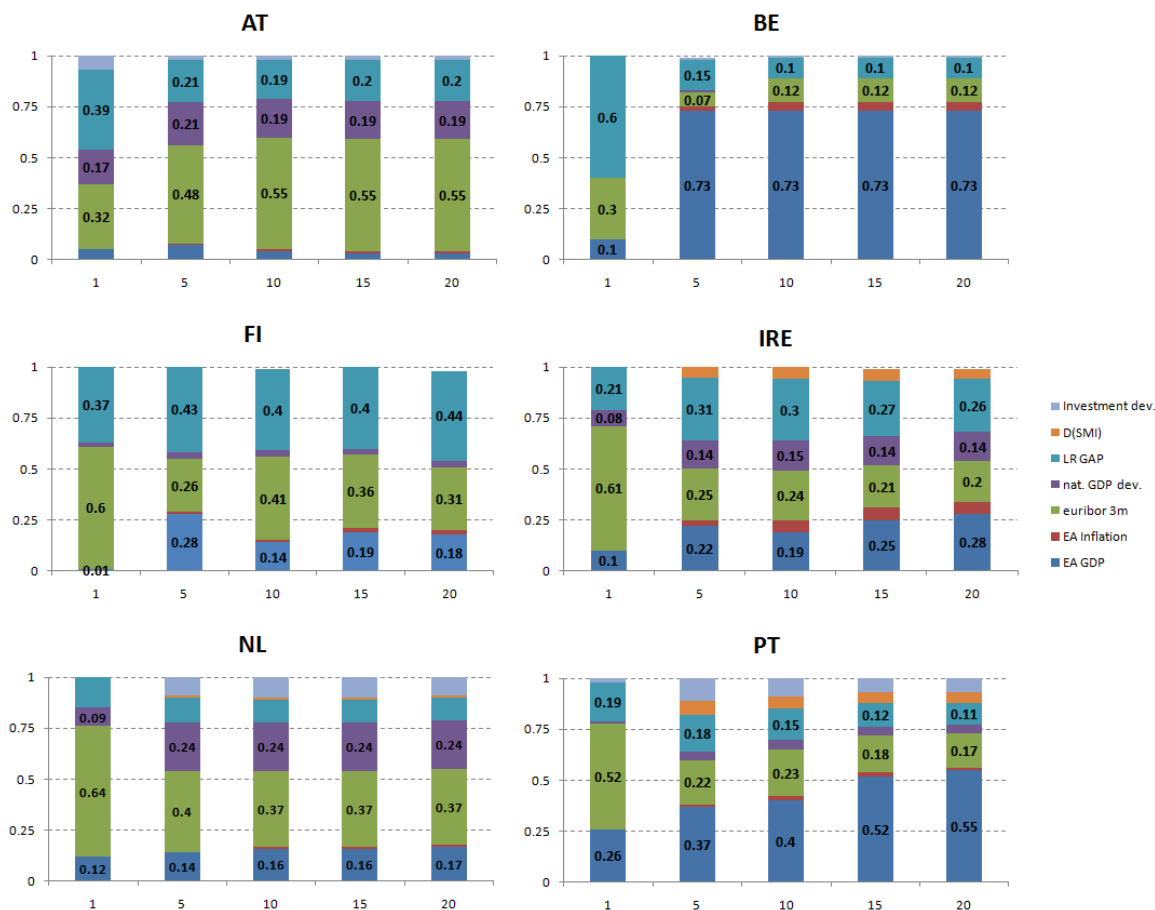
³For the Netherlands we initially used 2 lags for the country submodel as suggested by the AIC, which however led to unstable results. We re-estimated the Dutch model with only one lag, which led to stable impulse-response functions. All Dutch results shown below refer to the latter model.

causes aggregate demand to decrease and therefore leads to a decrease in inflation. The maximal effect can be observed eight quarters after the shock, as shown in table 3.1.

3.5.3 Determinants of bank and investment behaviour

Figures 3.2 and 3.3 display the implied forecast error variance decompositions of bank lending spreads and deviations of national real investment growth from national real GDP growth.

Figure 3.2 displays the sources of variation in bank lending spreads implied by model 3.1. A large part of the variation stems from monetary policy impulses as well as EA aggregate demand developments. Whereas for Austria, Finland and the Netherlands the variance in spreads can be primarily explained by the monetary policy shock, the EA aggregate demand shock is the dominant source of variation in Belgium, Ireland and Portugal. Furthermore national deviations of real GDP growth from EA real GDP growth appear to affect bank behaviour more significantly in Austria and the Netherlands (and to some extent also in Ireland) than in the remaining small EA members.

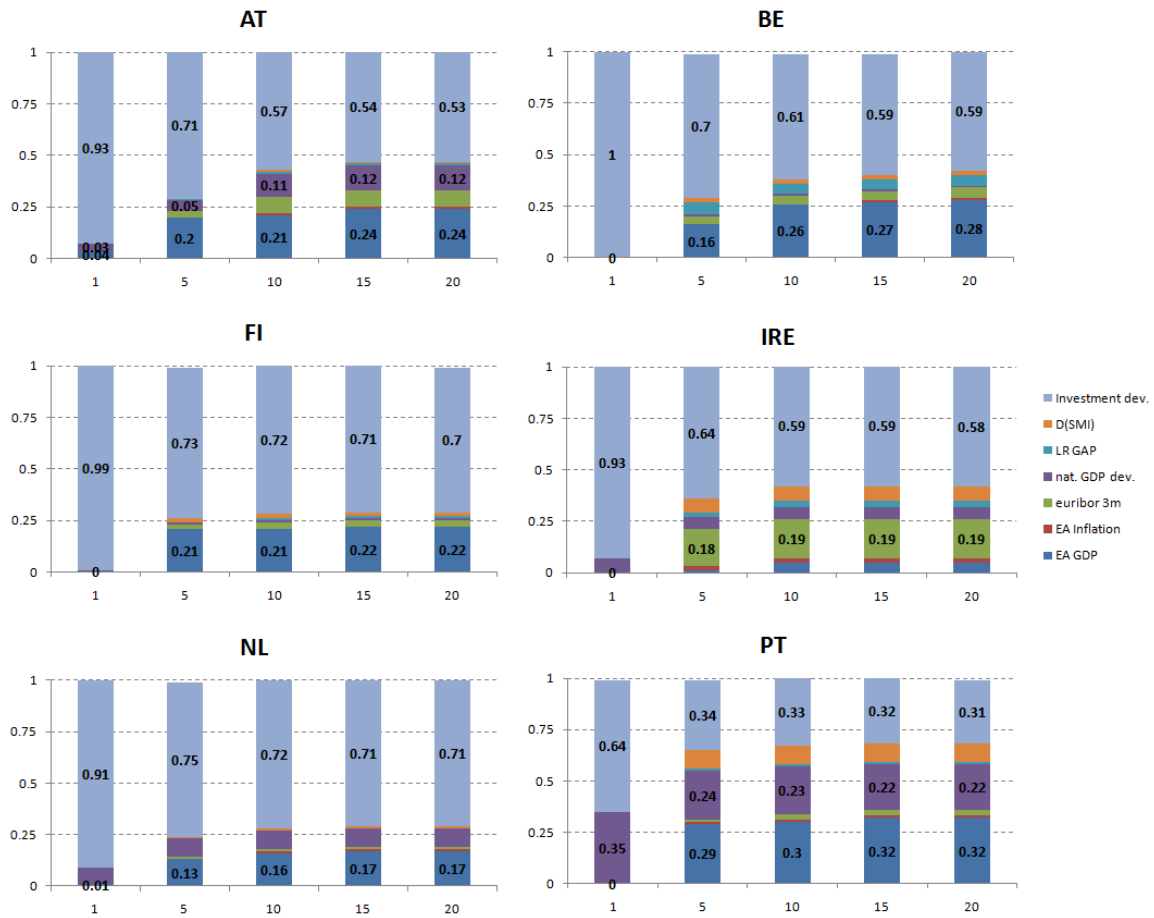


Source: own calculations.

Figure 3.2: Variance Decomposition: Bank lending rate - interbank interest rate spread

Figure 3.3 plots the sources of variation of the investment - GDP growth differential.

In all economies lagged own variation is the dominant source of variation for the growth differential. The second major source of variation stems from the EA aggregate demand shock, which would be expected in a small open economy. For Ireland we observe that past variation due to monetary policy shock explains up to 20 % of the variation in the deviation of national real investment growth from national real GDP growth. Interestingly deviations of national real GDP growth from EA real GDP growth appears to impact the deviation of national investment growth from national real GDP growth in Austria, the Netherlands and Portugal, a similar feature that could be observed in figure 3.2.

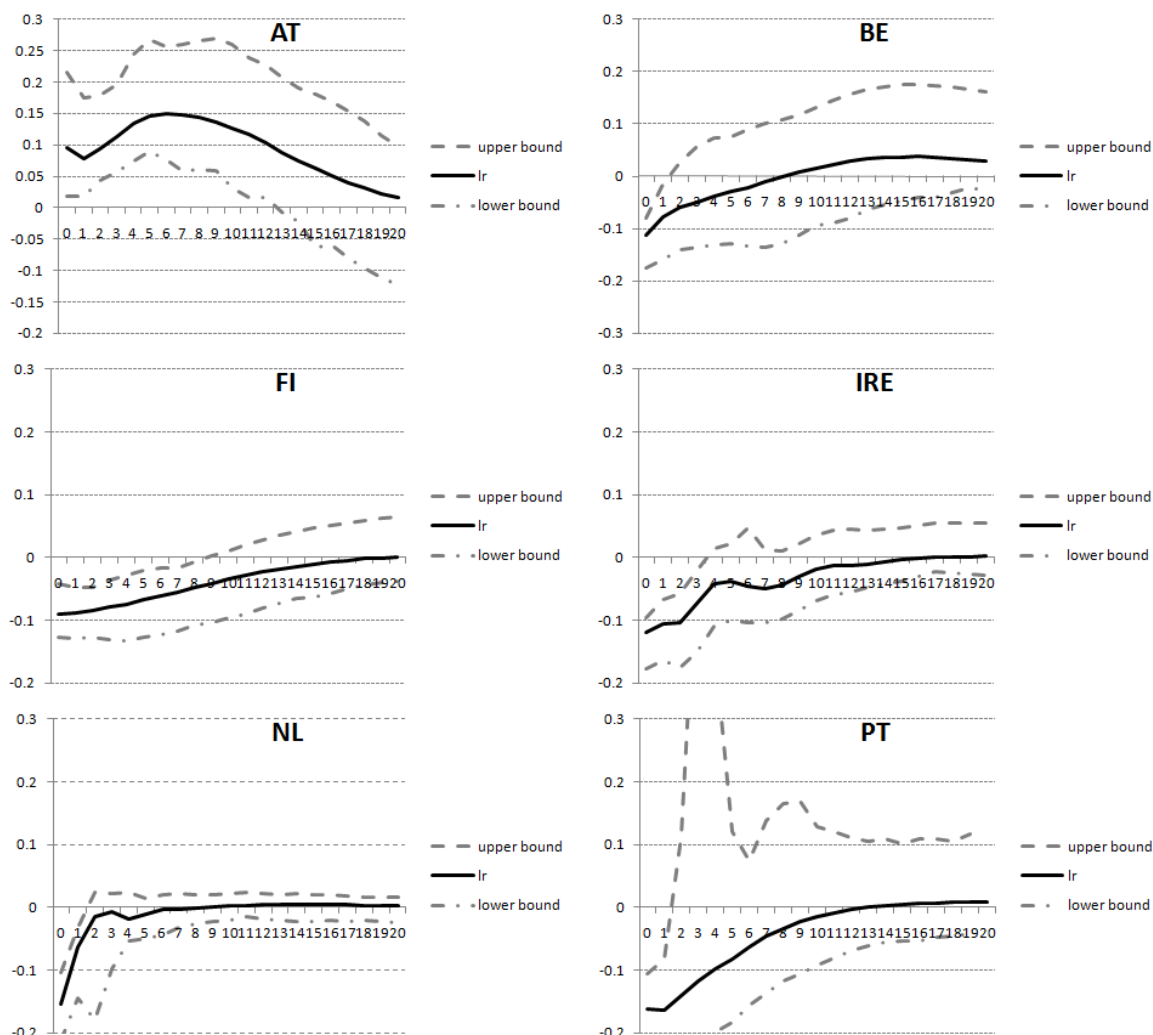


Source: own calculations.

Figure 3.3: Variance Decomposition: Investment behaviour

3.5.4 Bank Behaviour

Figure 3.4 displays the reaction of the spread between the bank lending rate and the interbank rate to a one s.d. increase in the monetary policy rate influenced by the ECB, implied by the structure of equation (3.2) in system (3.1).



Notes: Response of $r_{l,t} - r_{ecb,t}$ to a one s.d. deviation (30 Basis Points) increase in the Euroibor3M rate. The dashed lines are upper and lower bounds of the 95% bootstrapped confidence interval. Source: own calculations.

Figure 3.4: Deviation of bank lending rate from the Euribor3M

Similar to past studies of the interest rate pass-through we cannot observe an instantaneous and complete pass-through of monetary policy impulses through banks. There is a significant negative difference between the increase in the Euribor3M and the increase in bank lending rates, implying a spread of about a third (10 basis points) of the monetary impulse in the same quarter, the exception being Austria with a stronger increase in bank lending rates. For almost all economies the spread between the interbank rate and bank lending rate is back to normal levels after about 12 quarters, which is similar to results of De Bondt et al. (2005) for

the EA as a whole. However the spread is not significantly different from zero after about 2-3 quarters for most economies, which might indicate that the monetary policy is transmitted more quickly through the banking sector than suggested by the literature.

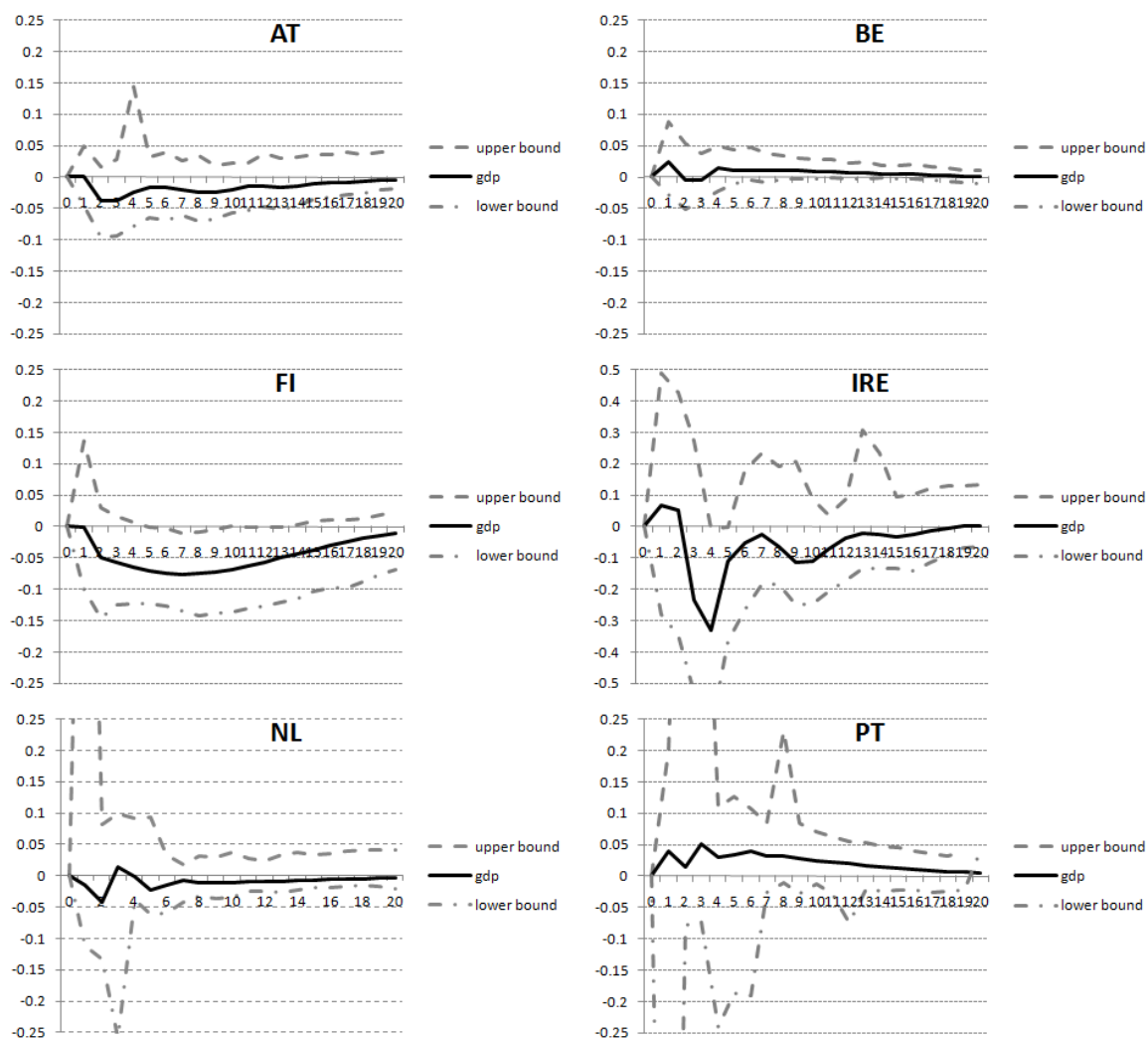
3.5.5 Differences in monetary policy effects on aggregate investment and GDP

Figure 3.5 displays the deviation in the national growth rate from the EA GDP growth rate following an interest rate shock of the ECB. This allows us to assess whether differences in monetary transmission might be due to differences in interest rate elasticities of GDP across countries. For Austria, Netherlands, Finland and Ireland we observe a slightly stronger impact of monetary policy in the first year, which is only significantly different from zero for the latter two economies. In case of Belgium and Portugal the impact of monetary policy on output appears to be weaker than in the EA as a whole, even though the difference is not statistically significant from zero.

Figure 3.6 displays the impact of a monetary policy shock to the difference in national investment and GDP growth. This indicates that investment in most small economies reacts more strongly than national GDP, however, with the exception of Ireland, the confidence bands indicate that these stronger effects are not statistically different from zero.

Summarising, monetary impulses appear to be more strongly transmitted by Austrian banks than in the other economies, on the other hand the impact on Austrian GDP and investment appear to be stronger, though the response functions are not different from zero in the latter cases. This indicates that investment and GDP appear to be less interest rate sensitive than in the other small economies. Monetary policy impulses are more sluggishly transmitted through the banking systems of all the other economies in the first eight quarters, for Finland and Ireland however the effects on investment and GDP are stronger, implying a higher interest rate sensitivities of these macroeconomic aggregates. For Belgium we observe a lower degree of transmission to output and a higher degree of transmission to investment, implying a higher interest rate sensitivity for Belgian investment and a lower interest rate sensitivity for Belgian GDP in general, even though this is not significantly different from zero. Portugal, following the same line of argument, displays a lower interest rate sensitivity of output as well as investment. In case of the Netherlands the transmission of monetary impulses through the banking system appears to be sluggish, the effects on Dutch real output appear to be more pronounced in comparison to the reaction of EA output pointing at a higher output sensitivity with respect to monetary policy shocks. On the other hand investment reacts weaker than national output suggesting a lower interest rate sensitivity of investment relative to output.

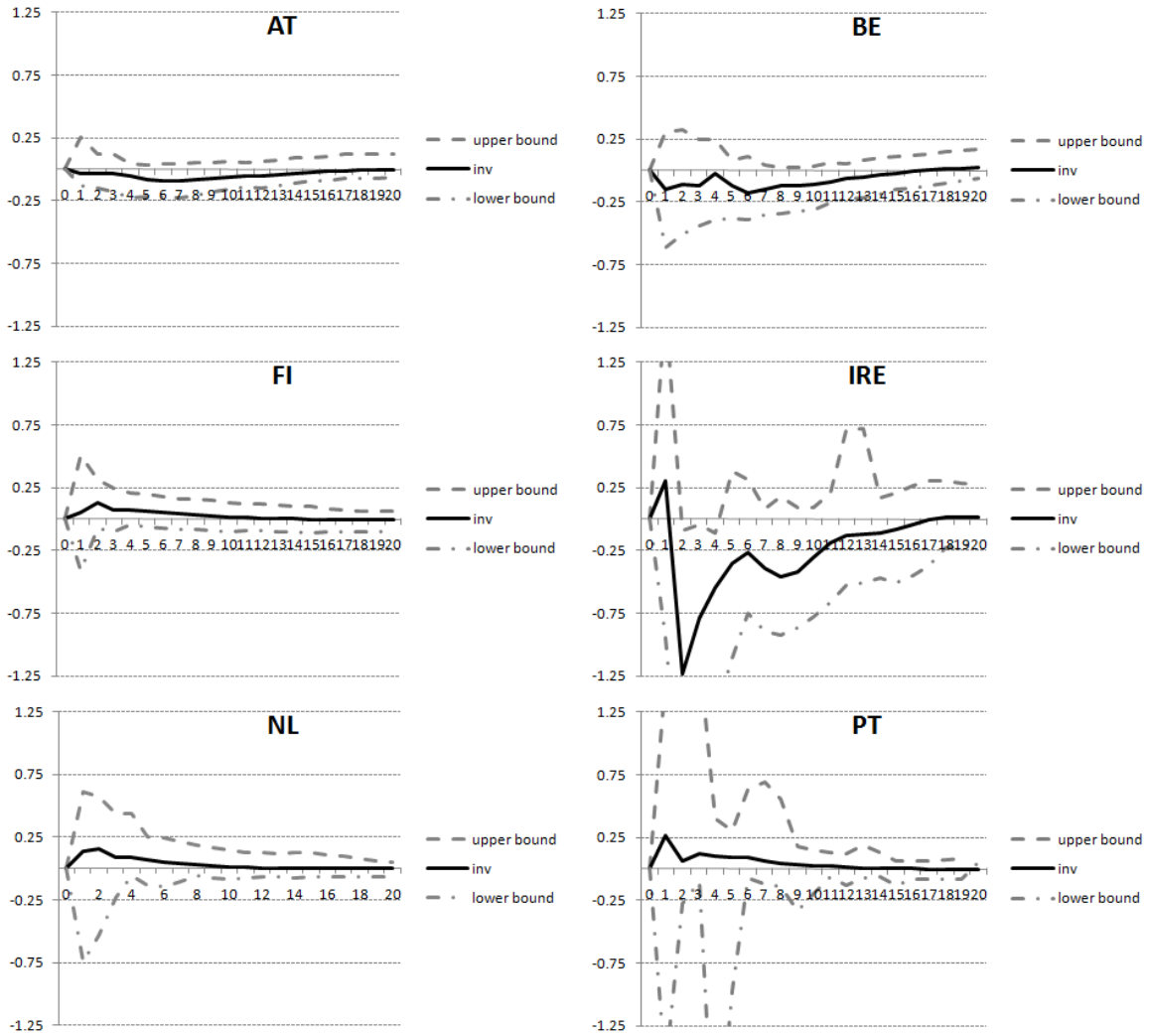
Our results indicate that bank behaviour is a major source of variation in the transmission mechanism of monetary policy. Whereas bank lending spreads significantly decrease initially after a monetary policy shock in most economies national investment sensitivities appear to be only marginally different from output elasticities. National output elasticities furthermore appear to be not statistically different from EA output elasticities. This seems to imply



Notes: Response of $\Delta y_{i,t} - \Delta y_{ea,t}$ to a one s.d. deviation (30 Basis Points) increase in the Euroibor3M rate. The dashed lines are upper and lower bounds of the 95% bootstrapped confidence interval.

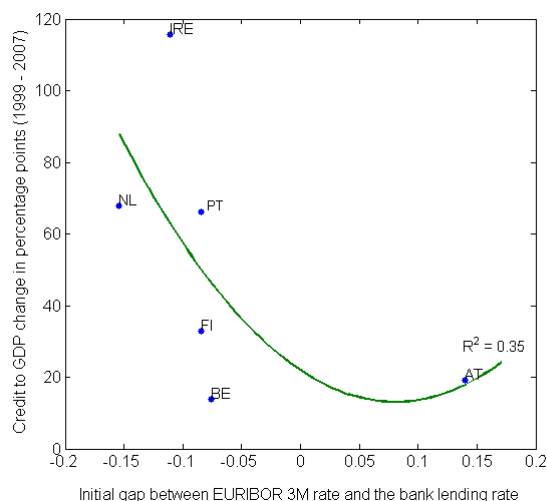
Source: own calculations.

Figure 3.5: Deviation of national GDP growth from EA GDP growth



Notes: Response of $\Delta i_{i,t} - \Delta y_{i,t}$ to a one s.d. deviation (30 Basis Points) increase in the Euroibor3M rate. The dashed lines are upper and lower bounds of the 95% bootstrapped confidence interval. Source: own calculations.

Figure 3.6: Deviation of national investment growth from national GDP growth



Source: own calculations.

Figure 3.7: Correlation of initial interest pass-through and credit/GDP change (1999 - 2007)

that different bank behaviour could be an explanation for the divergence of credit to GDP ratios after the introduction of the common currency. Figure 3.7 plots the change in credit to GDP ratios against the initial spread between bank lending and interbank interest rates. We can observe a negative correlation between the immediate pass-through of monetary policy impulses and the change in the credit to GDP ratio. This implies that the lower the degree of interest rate pass-through, the higher the change in the credit to GDP ratio. This suggests that bank behaviour might have been a major driver in diverging credit to GDP ratios.

3.6 Conclusions

In this article we set up an empirical framework to disentangle bank behaviour and investment behaviour in the credit channel of monetary policy transmission in small EA members. We estimated the model for the period 1999:1 - 2009:4 and tested whether the transmission of monetary policy impulses to small EA members is different.

Even though common shocks such as EA aggregate demand and monetary policy shocks appear to be a major source of variation for investment and bank lending activities, country specific information embodied in the variation in national variable still plays a role. This applies especially to bank behaviour.

Monetary policy appears to be transmitted at different speeds as well as to different degrees through the banking sector. For most five out of six economies we find that initially banks do not pass-through interest rate changes induced by the central bank instantaneously. Only Austrian banks appear to pass on interest rate impulses completely. The reaction of national GDP and national investment appears to be marginally significantly different from zero, which suggests that differences in monetary transmission might be due to bank behaviour and not investment behaviour. The different transmission of interest rates via national banking

systems thus appears to explain part of the divergence in the evolution of credit to GDP ratios observed since the introduction of the euro. This underlines the importance of banks for the transmission of monetary policy impulses highlighted in studies on the credit channel of monetary policy.

Appendix

Data

Variable	Name	Computation	Source
$y_{ea,t}$	EA real GDP	$\ln(\text{real GDP})$	OECD EO ¹
$\pi_{ea,t}$	EA inflation	$\ln(hicp_t/hicp_{t-1})$	OECD EO ¹
$r_{ecb,t}$	EA money market rate	EURIBOR3M	Eurostat
$y_{i,t}$	Country real GDP	$\ln(\text{real GDP})$	OECD EO ¹
$r_{sm,t}$	Country stock market return	$\ln(smi_{t-1}/smi_{t-1})^3$	TD ²
$i_{i,t}$	Country real investment	$\ln(\text{rgfcf})^4$	OECD EO ¹

¹ OECD economic outlook database;

² Thompson Reuters Datastream

³ stock market index

⁴ real gross fixed capital formation

Table 3.2: Data

lending rates			
Country	Variable	Continued with changes of	Source
Austria	$r_{l1,at}$	-	OENB*
	$r_{l2,at}$	-	OENB*
Belgium	$r_{l1,be}$	pcn from 2008:2	IFS
	$r_{l2,be}$	average of lending rates from 2008:2	IFS
Finland	$r_{l1,fi}$	pcn from 2003:3	IFS
	$r_{l2,fi}$	average of lending rates from 2003:3	IFS
Ireland	$r_{l1,ire}$	phm from 2006:3	IFS
	$r_{l2,ire}$	average of lending rates from 2006:3	IFS
Netherlands	$r_{l,nl}$		IFS
Portugal	$r_{l1,pt}$	T-bond 2000:2 - 2002:4 and pcn from 2003:2	IFS
	$r_{l2,pt}$	T-bond 2000:2 - 2002:4 and average of lending rates from 2003:2	IFS

* Austrian National Bank

Table 3.3: Lending Rate Data

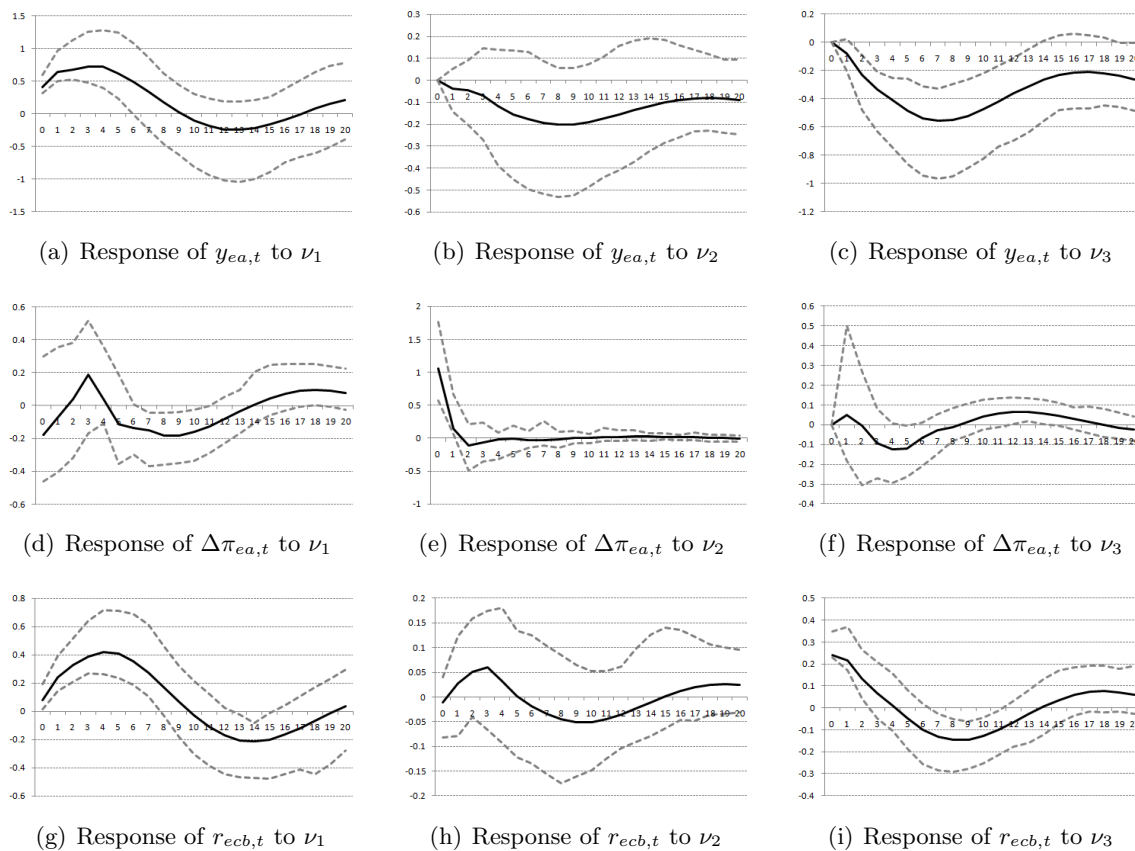
Lag lengths for the EA were selected using the EA submodel (first three equations) of the main model specified in equation system (3.1). The maximum possible lag length was chosen to be four. For the country submodels we searched up to two lags using only equations 4 - 7 in the system. This is due to the relatively low degrees of freedom using only 48 observation and the relatively large number of parameters in the stock market returns equation. We selected the optimal lag length of the unrestricted reduced form of this SVAR using AIC. Results are provided in table 3.6.

	AIC	SIC	searched up to lags
EA	3	1	4
Austria	2	1	2
Belgium	2	1	2
Finland	1	1	2
Ireland	2	1	2
Netherlands	2	1	2
Portugal	2	1	2

Source: own estimation.

Table 3.4: Lag Selection by AIC and SIC

Results



Notes: The first column displays the response of all variables to a one s.d. ν_1 shock. The second (third) column displays the reaction of all variables to a one s.d. ν_2 (ν_3) shock. The dashed lines are upper and lower bounds of the 95% bootstrapped confidence interval.
Source: own calculations.

Figure 3.8: Impulse Responses graphs of the EA submodel

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Abstract

The introduction of the euro represented a major change in the monetary policy regime of several European economies in the last decade. Such a change induces changes in agents' behaviour. Thus there are two major questions: How quickly do agents in these economies adapt to the new policy regime, and, related to the first question, do people in a common monetary currency area behave similarly once the common currency area is established? This thesis tries to provide answers to both questions using the introduction of the common currency as a natural experiment.

The first essay studies the effects of monetary policy in individual EMU member states in the first decade of the euro. Using SVAR country models for the sample starting in 1999Q1, we find a relatively homogeneous transmission of monetary policy to output, despite some adjustment mechanisms in some member countries. The reaction to external shocks appears to be homogeneous for the euro area and its member states in the first decade after the introduction of the common currency. Shocks to large EMU members' inflation rates might cause some concern for ECB monetary policy makers' target of a stable price level. The second essay highlights the importance of financial structure for the transmission of monetary policy impulses. For this purpose a model is estimated on the basis of which measures for the strength of monetary policy in the individual member states are calculated. Using this model, differences in monetary policy transmission between the EU-15 countries are investigated. We find that banks in economies with similar financial structure have similar reaction functions to monetary policy. We find evidence of a convergence of the monetary policy transmission mechanisms in Europe, which is stronger in economies with similar financial structures.

Despite a common monetary policy we can observe a different evolution of credit volumes between economies in the euro area in the first decade of the euro, as proxied by the credit to GDP ratio. As the monetary policy regime is the same, the third essay investigates whether these different developments are driven by credit supply or demand effects. We present a framework to disentangle credit supply and demand effects in the monetary transmission mechanism. We use our results to explain the evolution of credit volumes in individual member economies. We find that different bank behaviour in economies of the EA can explain part of the diverging evolution of credit volumes in the first decade of the euro.

Overall, even though short run effects of monetary policy appear to be similar in EA member economies, differences in the financial structure of EA member economies matter in the medium term. The second essay emphasises that banks in economies with a similar financial structure transmit monetary policy impulses similarly, in contrast to banks in economies with different financial structures. The third essay argues that because contractionary monetary policy impulses are not passed-through completely through the banking system in smaller EA member economies, credit growth is higher in these economies, which might lead to asymmetric medium term effects of the common monetary policy in these economies.

Zusammenfassung

Die Einführung des Euro stellt eine wesentliche Änderung der geldpolitischen Rahmenbedingungen einer Anzahl europäischer Ökonomien dar. Dies bewirkt eine Veränderung des Verhaltens von Wirtschaftssubjekten. Daraus ergeben sich zwei Fragen: Wie rasch passen sich Wirtschaftssubjekte in diesen Ländern an das neue geldpolitische Regime an und, damit verbunden, führt die gemeinsame Geldpolitik zu einer Homogenisierung der Reaktion der Wirtschaftssubjekte auf die Geldpolitik? Die vorliegende Arbeit versucht Antworten auf beide Fragen zu geben.

Der erste Aufsatz untersucht die Effekte der Geldpolitik in den einzelnen Volkswirtschaften des Euroraums im ersten Jahrzehnt der Gemeinschaftswährung. Die auf den SVAR Ländermodellen beruhenden Impuls-Antwort-Funktionen deuten auf eine weitgehende Homogenität der Übertragung geldpolitischer Impulse zum Bruttoinlandsprodukt hin, obgleich in einigen Ländern noch Anpassungsprozesse festgestellt werden können. Bei der Reaktion der Outputlücke und der Inflation auf exogene Shocks können keine wesentlichen Unterschiede in den einzelnen Ländern festgestellt werden. Länderspezifische Inflationsschocks in großen Euroraum-Volkswirtschaften dürften jedoch problematisch in Hinblick auf das EZB Ziel eines stabilen Preisniveaus sein.

Der zweite Aufsatz beleuchtet die Bedeutung der Finanzstruktur von Volkswirtschaften für die Übertragung geldpolitischer Impulse näher. Anhand des empirischen Modells kann die Stärke der geldpolitischen Transmission durch das Bankensystem in einzelnen EU-15 Staaten berechnet werden. Somit können mögliche Asymmetrien der Übertragung geldpolitischer Impulse zwischen EU-15 Staaten analysiert werden. Im Allgemeinen kann beobachtet werden, dass Banken in Ökonomien mit ähnlicher Finanzstruktur gleich auf die Geldpolitik ihrer Zentralbanken reagieren. Außerdem bestehen Anzeichen einer Konvergenz des geldpolitischen Transmissionsmechanismus, die stärker in Ökonomien mit ähnlicher Finanzstruktur ist.

Trotz einer gemeinsamen Geldpolitik konnte in den ersten zehn Jahren des Euro eine stark unterschiedliche Entwicklung bei den Kreditvolumina in Euroraum-Ökonomien beobachtet werden. Da sich das geldpolitische Regime nicht zwischen den einzelnen Mitgliedsstaaten unterscheidet, geht der dritte Aufsatz der Frage nach, ob diese unterschiedliche Entwicklung auf nachfrageseitige oder angebotsseitige Faktoren in den einzelnen Kreditmärkten zurückzuführen ist. Es wird ein analytischer Rahmen vorgestellt, der es erlaubt, diese im geldpolitischen Transmissionsmechanismus zu trennen. Die Ergebnisse dieses Aufsatzes deuten daraufhin, dass die unterschiedlichen Entwicklungen in den einzelnen Ökonomien des Euroraums vor allem durch angebotsseitige Kreditmarkteffekte erklärt werden können. Unterschiedliche Reaktionen von Banken in den Euroraum-Ökonomien scheinen für unterschiedliche Entwicklungen der Kreditvolumina verantwortlich zu sein.

Insgesamt betrachtet dürften die kurzfristigen Effekte der gemeinsamen Geldpolitik in Euroraum Mitgliedsstaaten bereits in den ersten zehn Jahren sehr ähnlich sein, Differenzen in den Finanzstruktur von Ökonomien dürften jedoch in der mittleren Frist Unterschiede in der geldpolitischen Transmission bedingen. Der zweite Aufsatz betont, dass Banken in Ökonomien mit ähnlicher Finanzstruktur geldpolitische Impulse ähnlich weitergeben - im Gegensatz zu Banken in Ökonomien mit unterschiedlicher Finanzstruktur. Der dritte Aufsatz zeigt, dass Banken kontraktionäre geldpolitische Impulse kurzfristig nicht gänzlich weitergeben und es somit zu einem unterschiedlichem Kreditwachstum in den kleineren Mitgliedsstaaten des Euroraums kommen kann, was mittelfristig auf asymmetrische Effekte der Geldpolitik im Euroraum hindeutet.

Curriculum Vitae

Wolfgang Schwarzbauer

Personal Information

E-mail address: wolfgang.schwarzbauer@ihs.ac.at

Citizenship: Austria

Marital Status: married

Date of Birth: 22nd September 1977

Education

since 10/2003 Doctoral Program in Social and Economic Sciences, University of Vienna
9/2003 - 9/2005 Postgraduate Diploma in Economics, Institute for Advanced Studies (IHS), Vienna
10/1997 - 4/2005 Mag.phil. in History (passed with distinction), University of Vienna
10/1996 - 4/2002 Mag.rer.soc.oec. in Economics, University of Vienna
09/2000 - 6/2001 Various courses at the Univ. of Birmingham, UK as an exchange student

Research Sabbaticals

09/2009 - 03/2010 Economics Department at the University of Maryland at College Park, Md, USA

Employment

since 10/2005 Researcher, Institute for Advanced Studies (IHS), Vienna
5/2002 - 09/2003 Project Assistant, Institute für Wirtschaft, Politik und Recht, University of Natural Resources and Life Sciences, Vienna

Teaching experience

Introduction to Economics, undergraduate course, *Univ. of Natural Resources and Life Sciences, Vienna*, Winter Terms 2005, 2006, 2007 and 2008

Introduction to Microeconomics, undergraduate course, *Lauder Business School*, Winter Terms 2007 and 2008.

Introduction to Macroeconomics, undergraduate course, *Lauder Business School*, Summer Terms 2008, 2009 and 2010

Awards and Fellowships

2004 – 2005 *Postgraduate scholarship*, IHS
2004 *DOC Scholarship*, Austrian Academy of Science
2002 *Weninger Award*, Austrian National Bank

Main Research Interests

Applied Econometrics

Empirical macroeconomics

Monetary economics

Economic Forecasting

Publications

Peer-Reviewed Journals

Nagl, P., Schwarzbauer, W. and Sellner, R. (2010), *Überlegungen zu Methoden der Bewertung des Nutzens von Maßnahmen im Verkehr*, Zeitschrift für Verkehrswissenschaften 81 (1), pp. 13 – 26.

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Contributions

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Other

Periodicals

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Language and Software Skills

Language Skills	German (native), English (fluent), French (moderate)
Software Skills	LaTeX, MS Office Applications, Matlab, EViews, Stata, Rats