

Faia, Ester

Working Paper

Financial Differences and Business Cycle Co-Movements in A Currency Area

Working Paper, No. 97

Provided in Cooperation with:

Oesterreichische Nationalbank (OeNB), Vienna

Suggested Citation: Faia, Ester (2005) : Financial Differences and Business Cycle Co-Movements in A Currency Area, Working Paper, No. 97, Oesterreichische Nationalbank (OeNB), Vienna

This Version is available at:

<https://hdl.handle.net/10419/264689>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

WORKING PAPER 97

FINANCIAL DIFFERENCES AND BUSINESS CYCLE CO-MOVEMENTS IN A CURRENCY AREA

ESTER FAIA

Editorial Board of the Working Papers

Eduard Hochreiter, Coordinating Editor
Ernest Gnan,
Guenther Thonabauer
Peter Mooslechner
Doris Ritzberger-Gruenwald

Statement of Purpose

The Working Paper series of the Oesterreichische Nationalbank is designed to disseminate and to provide a platform for discussion of either work of the staff of the OeNB economists or outside contributors on topics which are of special interest to the OeNB. To ensure the high quality of their content, the contributions are subjected to an international refereeing process. The opinions are strictly those of the authors and do in no way commit the OeNB.

Imprint: Responsibility according to Austrian media law: Guenther Thonabauer, Secretariat of the Board of Executive Directors, Oesterreichische Nationalbank

Published and printed by Oesterreichische Nationalbank, Wien.

The Working Papers are also available on our website:

<http://www.oenb.at>

Editorial

On the occasion of the 65th birthday of Governor Klaus Liebscher and in recognition of his commitment to Austria's participation in European monetary union and to the cause of European integration, the Oesterreichische Nationalbank (OeNB) established a "Klaus Liebscher Award". It will be offered annually as of 2005 for up to two excellent scientific papers on European monetary union and European integration issues. The authors must be less than 35 years old and be citizens from EU member or EU candidate countries. The "Klaus Liebscher Award" is worth EUR 10,000 each.

The winners of the first Award 2005 were Ester Faia and Federico Ravenna. Ester Faia's winning paper is presented in this Working Paper, while Federico Ravenna's contribution is contained in Working Paper 98.

In this paper, Ester Raia proposes a unitary framework to interpret the links between differences in financial structures and the monetary policy regimes on the one hand, and the correlation of business cycles on the other. Using a two-country micro-founded model with financial frictions, the author predicts that a greater financial diversity should reduce cyclical correlation under a given monetary regime, and that moving from independent monetary policies to a hard peg or a common currency should increase it, for any given degree of financial diversity. The recent experience of EMU is used to test these ideas, and it is shown that the model explains reasonably well the broad patterns of business cycle correlation observed recently among the main euro area countries.

May 12, 2005

Financial Differences and Business Cycle Co-Movements in A Currency Area*

Ester Faia[†]
Univesitat Pompeu Fabra

Revised March 2005.

Abstract

I propose a unitary framework to interpret the links between differences in financial structures and the monetary policy regimes on the one hand, and the correlation of business cycles on the other. Using a two-country micro-founded model with financial frictions I predict that a greater financial diversity should reduce cyclical correlation under a given monetary regime, and that moving from independent monetary policies to a hard peg or a common currency should increase it, for any given degree of financial diversity. I use the recent experience of EMU to test these ideas, and show that my model explains reasonably well the broad patterns of business cycle correlation observed recently among the main euro area countries.

JEL Classification Numbers: E3, E42, E44, E52, F41.

Keywords: financial diversity, monetary regimes, differential transmission mechanism.

*I thank Ignazio Angeloni, Thomas Cooley, Mark Gertler, Fabrizio Perri and Tommaso Monacelli. I gratefully acknowledge financial support from the DSGE grant. All errors are my own responsibility.

[†]Correspondence to: Department of Economics, Universitat Pompeu Fabra, Ramon Trias Fargas 25-26, Barcelona, Spain, 08005. E-mail address: ester.faia@upf.edu.

1 Introduction

The aim of this paper is to study how financial structures and monetary policy regimes (including exchange rate regimes) affect the pattern of business cycle correlation across countries. More specifically, I propose a unitary framework in which international business cycle co-movements are explained jointly by the differences between the financial systems and by the monetary policy regime adopted by the countries concerned.

The European Union is a prime example where my analysis is likely to be relevant. The 12 countries of the euro area have adopted a single currency but are still characterized by different financial structures, as a result of history, legal frameworks, collective preferences and politics¹. Financial regulations, legislation and bank supervisory policies of these countries have not been unified but remain largely under national control – though pressures towards harmonization and the adoption of common standards, partly as a result of the single currency, are mounting. Of the remaining EU members, many (including several new entrants from Central and Eastern Europe) will adopt the euro before or around the end of this decade, and also in preparation for that are introducing financial market reforms. This process of currency unification and financial reform taking place at continental level provides an ideal testing ground for my theory. Examining the implications of this for business cycles is clearly of important for many reasons, e.g. to determine the optimal monetary policy and to study the welfare properties of the currency area.

The approach I propose helps rationalize, within a common framework, two separate bodies of recent empirical findings. First, the empirical literature on the transmission mechanism has highlighted the central role of financial and banking structures, particularly in Europe, in shaping the strength and the timing of the effects of monetary policy on the economy. Moreover, an increase in the cyclical co-movement of the euro area countries in recent years has been reported. On both aspects, a short survey of recent papers is provided in the next section. Against this background, my theoretical model predicts that a lesser financial diversity increases the cyclical correlation for any given monetary regime, whereas moving from independent monetary policies to a currency peg or even more to a common currency tends to increase it, for any given degree of financial distance. As I show, a model embodying these features explains well the empirical patterns of business cycle correlation, and changes thereof, observed recently among the main European countries.

The argument proceeds in three steps. First, I lay out a laboratory economy with two regions, where the effects of financial diversity and of alternative monetary regimes on business cycle co-movements can be analyzed within a unified theoretical framework. The model economy is a stochastic dynamic general equilibrium with optimizing agents, characterized by adjustment costs on prices in an imperfectly competitive framework, by imperfect financial integration and different degrees of financial fragility. The presence of sticky prices is essential to analyze the effects of

¹The link between politics, legal frameworks and the financial systems are studied, for example, by La Porta et. Al (1997). Cecchetti (1999) demonstrates that there is link between these aspects and the transmission mechanism of monetary policy in the euro area.

endogenous monetary policy response. Imperfect financial integration means here that households do not have access to a complete set of state contingent international securities. Financial frictions are introduced by postulating borrowing constraints on investment due to asymmetric information between borrowers and lenders². Financial diversity is modelled in terms of asymmetric costs of bankruptcy and riskiness of investment projects. The external finance premium is proxied by the spread between bank lending rates (or corporate bond rates) over money market rates; the calibration is made with reference to the four largest euro area countries (Germany, France, Italy and Spain), with the UK and the US used as controls³. The external finance premium determines the tightness of the borrowing limit and is related to the conditions (i.e. the value) of the collateral in the economy. In this environment, the sensitivity of the borrowing limit to the collateral conditions is the key determinant of the link between financial fragility and the business cycle.

Second, the model is subject to monetary policy and productivity shocks calibrated using euro area data. I consider three monetary policy regimes. The first is a currency area in which monetary policy targets area-wide CPI inflation. In the second the two countries follow independent monetary policies, each targeting its own domestic CPI inflation. In the third, the home country targets its domestic CPI inflation and the foreign one unilaterally and credibly pegs its exchange rate⁴. In all three regimes, different elasticities of credit availability to collateral conditions between the two countries produce different business cycle responses to the monetary policy shocks, hence different degrees of persistence and volatility in real output and the other main macro variables. The differences in financial structures also generates differences in the return to capital investment which induces agents to relocate physical capital and investment projects abroad. Capital flows occur towards countries characterized by more profitable investment conditions - i.e. higher sensitivity of credit availability to leverage ratio. Due to both of these channels, lower business cycle co-movements arise as a result of higher financial distance.

The comparison across monetary regimes shows that, in the presence of financial differences, all macro variables are more synchronized in a currency area than under an independent policy regime. In both regimes, the different sensitivity of the borrowing conditions to collateral give rise to different sensitivity of business cycle fluctuations to shocks. Under independent policies, however, the endogenous response of national monetary policy to such differences in fluctuations tends to amplify the non-synchronism of cycles. Under the unilateral peg, the business cycle co-movements are very close to the ones arising under the currency area regime - the difference generated by the fact that in this regime the monetary policy target is the home country's inflation rate, not the one of the area, turns out to be small.

²See for closed economy models Bernanke, Gertler, Gilchrist (1999), Carlstrom and Fuerst (1997), Cooley and Nam (1998).

³This empirical measure embodies several features of the domestic financial system, including the degree of banking sector efficiency in terms of bankruptcy and operating costs, the importance of leverage as well as the riskiness of investment projects.

⁴At present, a few EU nations peg their exchange rates closely to the euro, like e.g. Denmark, Estonia, Lithuania and Slovenia.

The third step is to show that the model predictions broadly correspond to the data evidence. I do this for the four largest euro area countries⁵, using the UK and the US as control cases. To do this, cross-country correlations of output, consumption, investment and employment generated by the model are compared with the empirical counterparts. The independent policies and the currency area regimes in the model are compared, respectively, with the pre-EMU and the post-EMU periods. The model successfully replicates the broad patterns of empirical correlations.

The paper is organized as follows. Section 2 reviews the empirical literature on the transmission mechanism in the euro area and documents the presence of differences in the financial markets. Section 3 presents the model, which is then calibrated in section 4. Section 5 shows the responses to monetary policy shocks and how they are modified under the different financial and monetary regimes. Finally, section 6 compares the model results with the data, and section 7 concludes. Tables and graphs are reported at the end of the paper.

2 Recent Literature and Stylized Facts

Two recent strands of literature are particularly relevant for this paper. The first, started in the late 1990s and increasingly active in recent times, focuses on the transmission of monetary policy in the euro area. A focal point in this literature has been the question of whether the monetary transmission mechanism differs across euro area countries, and if so, what role the financial structures play in generating these asymmetries. The second strand of literature concentrated on measuring the degree of cyclical coherence among these countries, mainly with the aim of determining whether the EMU is an “optimal currency area”. The general conclusion of this literature is that cyclical convergence in Europe has increased during the EMU preparation phase, but that significant cyclical asymmetries still exist. Interestingly, this second line of research has remained so far unrelated to the first: the possibility that the differences in the transmission mechanism, stemming from the financial structures, may be themselves a factor of cyclical asynchrony, and the simultaneous effect produced by the change in monetary regime, do not seem to have been directly analyzed up to now.

Several authors have argued that the euro area monetary transmission mechanism is uneven across euro area countries, and have pointed at the financial systems as the reason for that. In particular, Cecchetti (1999) and Guiso et al. (1999) argued that deeply entrenched legal and institutional structures prevent a homogeneous response of the economy to monetary policy shocks, which of course have become identical after the introduction of the euro. Giovannetti and Marimon (1999) use VAR methodology to conclude that monetary policy shocks give rise in fact to differential transmission mechanisms, a conclusion shared by Mihov (2001). Ceccarelli and Rebucci (2003)

⁵At present, the main obstacle to an extensive empirical investigation along these lines is in the availability of statistical data. In several EU countries (most notably, the new members from Central and Eastern Europe) sufficient long, good quality statistics on national accounts are not available. This restricts the number of countries on which a meaningful analysis can be conducted.

confirm these results using Bayesian estimation methods, but point out that the differences refer more to the time profile of the responses, rather than to their overall magnitude. A comprehensive recent study conducted by the euro area central banks (Angeloni, Kashyap and Mojon (2003)) confirms the role of banking lending behavior in shaping certain feature of the euro area transmission mechanism. Finally, Angeloni and Ehrmann (2003) using post-1999 data find that certain segments of the transmission mechanisms may have become more similar across countries after the launch of EMU, though differences still persist.

For illustration, table (1) shows a few simple indicators of the financial structure for the main euro area countries. The reference periods differ somewhat across indicators, due to data availability. The first three columns refer to the banking sector: the return on assets (ROA) of the sector⁶, the Thomson rating measure⁷ and the marginal cost of long term bank financing recently published by the ECB⁸. These data show that there is a marked heterogeneity among bank structures. Looking at the rankings among the largest 4 countries, the ROA is lowest for Germany and highest for France and Spain. It may thus come as a surprise that the Thomson rating assigns the highest score to Germany. This is likely to depend largely on the highly protected condition of the German banking sector, still characterized by extensive state guarantee. The marginal lending rates suggest the following decreasing order: Germany, France, Italy, Spain. The last two columns of table (1) refer instead to the non-financial corporate sector: the ratio of external finance of firms to GDP⁹ and a crude measure of leverage, calculated dividing the volume of outstanding loans by the total equity of the corporate sector in 2001¹⁰. Germany is again at the top of the list for external finance, followed by France, Italy and Spain. Leverage follows the same order, except that France is characterized by a lower value than the other countries. France seems to be atypical also because of a large presence of shares in both the asset and the liability side of the balance sheet of firms. This is likely to reflect the presence of a complex cross-ownership structure that could make simple measures of leverage less meaningful.

The other line of empirical literature we mentioned examines the extent of business cycle synchronization. Earlier studies (Artis and Zhang (1997), Angeloni and Dedola (1999)) find that cross-correlation of real cycles and inflation has risen in recent years among EMU participants. More recently Canova et al. (2002) also find that business cycle synchronization in Europe has been increasing over the 1990's. Interestingly Sensier et al. (2002) identify area specific common factors in business cycle fluctuations across countries belonging to currency areas while Heatcote and Perri (2001) find business cycle divergence across large currency blocs mostly in recent years.

⁶Data are an average over the 1990-1999 and are taken from IBCA Bankscope.

⁷See Cecchetti (1999). A lower value for this statistic identifies a more efficient banking system.

⁸This measure consists in the average interest rate charged in 2003Q1-2004Q2 by all banks on all new loans with maturity greater than one year. This indicator is of particular interest since it is based on a standardized European methodology.

⁹This indicator, taken from Cecchetti (1999), refers to the 1996.

¹⁰Own calculations using data from Angeloni, Kashyap and Mojon (2003).

3 A Two-Region Model with Financial Heterogeneity

There are two regions of equal size. Regions are symmetric in all respect but differ in the severity of the agency problem which characterizes the contractual relationship between the lender and the borrower.

Each economy is populated by two sets of agents, workers and entrepreneurs, that account for a total measure of one. Each agent is simultaneously consumer and investor. The assumption of agents' heterogeneity is essential in order to model the lender-borrower relationship. Workers are the owners of a monopolistic sector which produces different varieties using capital and labor and faces quadratic price adjustment costs à-la Rotemberg (1982)¹¹. Varieties are then assembled into final goods by a competitive production unit. Domestic and imported final goods are also assembled by the competitive unit. Entrepreneurs invest in capital which they rent to the production sector and face idiosyncratic shocks on the return to investment. To finance capital entrepreneurs use internal funds as well as external borrowing. Indeed a financial intermediary collects funds from the workers - i.e. the lenders - and after pooling resources provides loans to the entrepreneurs - i.e. borrowers. As the loan contractual relationship is subject to an agency problem the borrowers must pay a premium on external finance.

Let $s^t = \{s_0, \dots, s_t\}$ denote the history of events up to date t , where s_t denotes the event realization at date t . The date 0 probability of observing history s^t is given by $\rho(s^t)$. The initial state s^0 is given so that $\rho(s^0) = 1$. Henceforth, and for the sake of simplifying the notation, let's define the operator $E_t\{\cdot\} \equiv \sum_{s_{t+1}} \rho(s^{t+1}|s^t)$ as the mathematical expectations over all possible states of nature conditional on history s^t .

3.1 Workers Behavior in the Each Region

Workers in each country are risk averse and infinite lived. They consume a variety of goods, supply labor, invest in domestic and international asset markets and run the monopolistic production sector. In what follows I spell out the optimization problem of the domestic workers first. They maximize the following expected discounted sum of utilities:

$$E_t \left\{ \sum_{t=0}^{\infty} \beta^t [U(C_t) - V(N_t)] \right\} \quad (1)$$

where C denotes aggregate consumption in final goods and N denotes total labor hours. U is increasing, concave and differentiable while V is increasing, convex and differentiable. Workers receive at the beginning of time t a labor income of $W_t N_t$, where W_t is the nominal wage. In order to finance consumption at time t they invest in domestic deposits, D_t , which are denominated in

¹¹The assumption of a symmetric price adjustment cost allows to model firm decisions within a single production sector. This happens despite the heterogeneity induced by the idiosyncratic shock to the return on capital investment. In the Bernanke, Gertler, Gilchrist (1999) aggregation within one single sector is not possible since the assumption of sticky prices à la Calvo (1983) induce an extra source of firms heterogeneity.

units of domestic final good and pay a return, R_t^D , one period later. They also invest in a portfolio of internationally traded securities, B_t^* , which are denominated in units of foreign final good and pay a return, R_t^F , one period later. The sequence of budget constraints in units of final goods reads as follows:

$$C_t + D_t + B_t^* e_t^r \leq \frac{W_t}{P_t} N_t + \frac{\Theta_t}{P_t} + R_{t-1}^D D_{t-1} + R_{t-1}^F B_{t-1}^* e_t^r \quad (2)$$

where Θ_t are the nominal profits of the domestic monopolistic firms, whose shares are owned by the domestic residents, $e^r = \frac{eP^*}{P}$ is the real exchange rate while e is the nominal exchange rate. Under the currency area regime the nominal exchange rate is set equal to one. In this case the real exchange rate, $e^r = \frac{P^*}{P}$, equates the ratio of the CPI price levels.

Households choose the set of processes $\{C_t, N_t, D_t, B_t^*\}_{t=0}^\infty$ taking as given the set of processes $\{P_t, W_t, R_t^D, R_t^F\}_{t=0}^\infty$ and the initial wealth D_0, B_0^* so as to maximize (1) subject to (2). The following optimality conditions must hold:

$$U_{c,t} \frac{W_t}{P_t} = -U_{n,t} \quad (3)$$

$$U_{c,t} = \beta R_t^D E_t \{U_{c,t+1}\} \quad (4)$$

$$U_{c,t} = \beta R_t^F E_t \left\{ U_{c,t+1} \frac{e_{t+1}^r}{e_t^r} \right\} \quad (5)$$

Equation (3) gives the optimal choice of labor supply. Equation (4) is the Euler condition with respect to home deposits. Equations (5) is the Euler condition with respect to the foreign security.

Arbitrage condition and accumulation of assets. The real interest rate in the home region is given by the return on domestic deposits:

$$R_t = R_t^D$$

Due to imperfect capital mobility and/or in order to capture the existence of intermediation costs in foreign asset markets workers pay a spread between the interest rate on the foreign currency portfolio and the interest rate of the foreign country. This spread is proportional to the (real) value of the country's net foreign asset position:

$$\frac{R_t^F}{R_t^*} = -\zeta (e_t^r B_t^*) \quad (6)$$

where $\zeta > 0$ ¹², $\zeta' > 0$. In addition I assume that the initial distribution of wealth between the two countries is symmetric. Aggregating the budget constraints of the workers and substituting for (6)

¹²As shown in Schmitt-Grohe and Uribe (2001) and Benigno (2002) this assumption is needed in order to maintain the stationarity in the model. Schmitt-Grohe and Uribe (2001) also show that adding this spread - i.e. whose size has been found negligible in Lane and Milesi-Ferretti (2001) - does not change significantly the behavior of the economy as compared to the one observed under the complete asset market assumption or under the introduction of other inducing stationarity elements - see Mendoza (1991), Senhadji (1994).

I obtain the following law of motion for the accumulation of bonds:

$$e_t^r B_t^* \leq R_t^* \zeta(e_t^r B_t^*) e_t^r B_{t-1}^* + \left[\frac{\Theta_t}{P_t} + \frac{W_t}{P_t} N_t \right] - [D_t - R_{t-1} D_{t-1}] - C_t \quad (7)$$

Workers in the Foreign Region. I assume throughout that all goods are traded, that both countries face the same composition of consumption bundle and that the *law of one price* holds. This implies that $P_H(i) = e P_H^*(i)$, $P_F(i) = e P_F^*(i)$ for all $i \in [0, 1]$. Again under the currency union regime the nominal exchange rate is equal one.

Foreign workers face an allocation of expenditure and wealth similar to the one of the workers in the domestic region except for the fact that they do not pay an additional spread for investing in the international portfolio. The budget constraint of the foreign representative household reads (expressed in units of foreign consumption index) as follows:

$$C_t^* + B_t^* + D_t^* \leq \frac{W_t^*}{P_t^*} N_t^* + \frac{\Theta_t^*}{P_t^*} + R_{t-1}^* B_{t-1}^* + R_{t-1}^{D*} D_{t-1}^* \quad (8)$$

The efficiency conditions for bonds' holdings and deposits read as follow:

$$U_{c^*,t} = \beta R_t^* E_t \{U_{c^*,t+1}\} \quad (9)$$

$$U_{c^*,t} = \beta R_t^{D*} E_t \{U_{c^*,t+1}\} \quad (10)$$

The returns on the deposits and on the international securities are clearly equalized by arbitrage condition.

After substituting equation (6) into equation (5) and after imposing arbitrage between regional returns on international securities I obtain the following relation:

$$E_t \left\{ \frac{U_{c,t+1}^*}{U_{c,t}^*} \right\} = -E_t \left\{ \frac{U_{c,t+1}}{U_{c,t}} \frac{e_{t+1}^r}{e_t^r} \zeta(e_t^r B_t^*) \right\} \quad (11)$$

which states that marginal utilities across countries are equalized up to a spread for the country risk.

The nominal interest rate are defined as $R_t^{n*} = R_t^* \frac{P_{t+1}^*}{P_t^*}$, $R_t^n = R_t \frac{P_{t+1}}{P_t}$. Under the currency area regime equation 11 implies that nominal interest rates are equalized up to the country risk:

$$R_t^{*n} = R_t^n \zeta(e_t^r B_t^*) \quad (12)$$

3.2 The Entrepreneurs in Each Region

In what follows I derive the maximization problem for the entrepreneurs in the home region. The one for foreign entrepreneurs is exactly symmetric. The entrepreneurs are the borrowers in this economy. They consume and invest in capital. In each period they rent to firms in the production sector the existing capital stock that they own and finance investment in new capital. To finance

the purchase of new capital they need to acquire a loan from a competitive intermediary that raises funds through deposits.

The return on capital is subject to an idiosyncratic shock, ω^j . At the beginning of each period the entrepreneur observes the aggregate shock. Before buying capital, the entrepreneur goes to the loan markets and borrows money from the intermediary by making a contract which is written before the idiosyncratic shock is recognized. The intermediary can privately observe the idiosyncratic shock only by paying a monitoring cost which is proportional to output production. As this informational asymmetry creates a moral hazard problem the entrepreneur needs to pay a premium to obtain external finance. As we shall see later in the section describing the optimal contract the assumption of a monitoring technology exhibiting constant returns to scale implies *linearity and symmetry* of the relationships which characterize the contracting problem. In turn the linearity of the optimal contract allows aggregation of entrepreneurial consumption and investment demand (simply summing across entrepreneurs). Hence we can spell out the consumption/investment problem of the entrepreneurs by imposing symmetry ex-ante. Finally I assume that entrepreneurs are risk neutral and that they have a survival probability ς ¹³. Each Entrepreneur chooses a sequence $\{C_t^e, I_t, K_{t+1}, L_t\}_{t=0}^\infty$ to maximize:

$$E_0 \sum_{t=0}^{\infty} (\varsigma\beta)^t C_t^e, \quad \varsigma\beta \leq \beta \quad (13)$$

subject to the following sequence of constraints:

$$\frac{Z_t}{P_t} K_t + L_{t+1} + \Sigma_t = C_t^e + I_t + R_t^L L_t \quad (14)$$

$$K_{t+1} = (1 - \delta)K_t + I_t - \Phi\left(\frac{I_t}{K_t}\right) K_t \quad (15)$$

Equation (14) is the entrepreneurs' budget constraint in units of final goods. Wealth is derived from rental income $\frac{Z_t}{P_t} K_t$ for production, new loans L_t , and a transfer of wealth, Σ_t , from old agents. The presence of the transfer Σ_t assures that aggregate net wealth is different from zero in the steady state. Expenditure is allocated in final good consumption C_t^e , investment I_t and in the service of the predetermined loan debt, $R_t^L L_t$. Constraint (15) indicates that, when investing in capital, entrepreneurs face adjustment costs. The cost function $\Phi(\cdot)$ is convex and satisfies $\Phi(\delta) = 0$ and $\Phi'(\delta) = 0$, where δ is the depreciation rate of capital.

Let's define $\{\lambda_t, Q_t\}_{t=0}^\infty$ as the sequence of Lagrange multipliers on the constraints (14) and (15) respectively. The first order conditions of the above problem read as follows:

$$\lambda_t = 1 \quad (16)$$

¹³In this respect I follow Kiyotaki and Moore (1997) and Carlstrom and Fuerst (1997). This assumption assures that entrepreneurial consumption occurs to such an extent that self-financing never occurs and borrowing constraints on loans are always binding.

$$\lambda_t = \varsigma \beta E_t \{ R_t^L \lambda_{t+1} \} \quad (17)$$

$$Q_t \left[1 - \Phi' \left(\frac{I_t}{K_t} \right) \right] = \lambda_t \quad (18)$$

$$Q_t = \varsigma \beta E_t \left\{ \frac{Z_{t+1}}{P_{t+1}} \lambda_{t+1} + Q_{t+1} \left(1 - \delta + \frac{I_{t+1}}{K_{t+1}} \Phi' \left(\frac{I_{t+1}}{K_{t+1}} \right) - \Phi \left(\frac{I_{t+1}}{K_{t+1}} \right) \right) \right\} \quad (19)$$

Equation (16) simply states that, due to risk neutrality, the marginal utility of additional real income is constant. Equation (17) is the Euler efficiency condition on the loan holding. Equations (18) and (19) are the efficiency conditions on capital investment. Notice that the lagrange multiplier Q_t denotes the real shadow value of installing new capital and thus plays the role of the implicit price of capital (or asset price).

In the simulation experiments I will also assume that entrepreneurs plan production one period in advance. It can be shown that this simply amounts in satisfying the following condition for the price of capital:

$$E_{t-1} \left[1 - \Phi' \left(\frac{I_t}{K_t} \right) \right]^{-1} = E_{t-1} Q_t \quad (20)$$

This hypothesis helps to capture the hump shaped response of investment and a more persistent dynamic of output and investment in response to monetary shocks. However notice that this change in timing is in no way affecting the main qualitative and quantitative results of the model.

In order to derive the aggregate consumption function it is worth to notice that the probability of dying for the entrepreneurs corresponds, by law of large numbers, to the fraction of entrepreneurs that effectively die in each period. The population is held steady by the birth of a new entrepreneur for each dying one. Under those assumptions entrepreneurs behave as permanent income consumers since they consume a constant fraction, ς , of their end of period wealth, NW_t , net of transfers to future generations:

$$C_t^e = \varsigma (NW_t - \Sigma_t) \quad (21)$$

For notational convenience let's define $\mathcal{Y}_t^k \equiv \frac{Z_t}{P_t} + Q_t \left(1 - \delta + \frac{I_t}{K_t} \Phi' \left(\frac{I_t}{K_t} \right) - \Phi \left(\frac{I_t}{K_t} \right) \right)$ as the *real income* from holding one unit of capital. Hence the *return* from holding a unit of capital between t and $t + 1$ reads as:

$$R_{t+1}^k \equiv E_t \left\{ \frac{\mathcal{Y}_{t+1}^k}{Q_t} \right\} \quad (22)$$

3.3 The Loan Contract Between the Borrower and the Financial Intermediary

At the *end of period* t a continuum of entrepreneurs (indexed by j) needs to finance the purchase of new capital K_{t+1}^j that will be used for production in period $t + 1$. In order to acquire a loan

the entrepreneurs have to engage in a financial contract *before* the realization of an idiosyncratic shock, ω^j (with a payoff paid after the realization of the same shock). The idiosyncratic shock has positive support, is independently distributed (across entrepreneurs and time) with a lognormal distribution, $F(\omega)$, with unitary mean, and density function $f(\omega)$. The return of the entrepreneurial investment is observable to the outsider only through the payment of a monitoring cost $\mu \mathcal{Y}_{t+1}^k K_{t+1}^j$, which is proportional to the expected return on capital purchased at the end of period t .

Before entering the loan contract agreement each entrepreneur owns end-of-period internal funds for an amount NW_{t+1}^j and seeks to finance the purchase of new capital $Q_t K_{t+1}^j$. It is assumed that the required funds for investment exceed internal funds. Hence in every period each entrepreneur seeks for a loan (in real terms):

$$L_{t+1}^j = Q_t K_{t+1}^j - NW_{t+1}^j \geq 0 \quad (23)$$

The financial contract assumes the form of an optimal debt contract à la Gale and Hellwig (1983). When the idiosyncratic shock to capital investment is above the cut-off value which determines the default states the entrepreneurs repay an amount R_{t+1}^L ¹⁴. On the contrary, in the default states, the bank monitors the investment activity and repossesses the assets of the firm.

Default occurs when the return from the investment activity $\omega_{t+1}^j \mathcal{Y}_{t+1}^k K_{t+1}^j$ falls short of the amount that needs to be repaid $R_{t+1}^L L_{t+1}^j$. Hence the *default space* is implicitly defined as the range for ω such that :

$$\omega_{t+1}^j < \varpi_{t+1}^j \equiv \frac{R_{t+1}^L L_{t+1}^j}{\mathcal{Y}_{t+1}^k K_{t+1}^j} \quad (24)$$

where ϖ_{t+1}^j is a cutoff value for the idiosyncratic productivity shock.

3.4 The optimal debt contract

Let's define by $\Gamma(\varpi^j)$ and $1 - \Gamma(\varpi^j)$ the fractions of net capital output received by the lender and the entrepreneur respectively. Hence we have:

$$\Gamma(\varpi_{t+1}^j) \equiv \int_0^{\varpi_{t+1}^j} \omega_{t+1}^j f(\omega) d\omega + \varpi_{t+1}^j \int_{\varpi_{t+1}^j}^{\infty} f(\omega) d\omega$$

Expected monitoring costs are defined as

$$\mu M(\varpi_{t+1}^j) \equiv \mu \int_0^{\varpi_{t+1}^j} \omega_{t+1}^j f(\omega) d\omega$$

with the *net share* accruing to the lender being $\Gamma(\varpi_{t+1}^j) - \mu M(\varpi_{t+1}^j)$. The real return paid on deposits is given by the safe rate, R_t , which as such corresponds, for the lender, to the opportunity cost of financing capital¹⁵. The *participation constraint* for the lender states that the expected

¹⁴In every period t this amount must be independent from the idiosyncratic shock in order to satisfy incentive compatibility conditions.

¹⁵This is also so because of the intra-period nature of the contract.

return from the lending activity should not fall short of the opportunity cost of finance:

$$\mathcal{Y}_{t+1}^k K_{t+1}^j (\Gamma(\varpi_{t+1}^j) - \mu M(\varpi_{t+1}^j)) \geq R_t (Q_t K_{t+1}^j - NW_{t+1}^j) \quad (25)$$

The contract specifies a pair $\{\varpi_{t+1}^j, K_{t+1}^j\}$ which solves the following maximization problem:

$$\text{Max } (1 - \Gamma(\varpi_{t+1}^j)) \mathcal{Y}_{t+1}^k K_{t+1}^j \quad (26)$$

subject to the participation constraint (25). Let χ_t be the lagrange multiplier on (25). First order conditions with respect to ϖ_{t+1}^j and K_{t+1}^j read as follows:

$$\Gamma'(\varpi_{t+1}^j) = \chi_t (\Gamma'(\varpi_{t+1}^j) - \mu M'(\varpi_{t+1}^j)) \quad (27)$$

$$\frac{R_{t+1}^k}{R_t} \left((1 - \Gamma(\varpi_{t+1}^j)) + \chi_t (\Gamma(\varpi_{t+1}^j) - \mu M(\varpi_{t+1}^j)) \right) = \chi_t \quad (28)$$

In addition, with $\chi_t > 0$, (25) must hold with equality.

3.4.1 Aggregation

Two assumptions make aggregation feasible: 1) A constant fraction ς of entrepreneurs remain alive in every period. 2) The optimal contract involves both a cut-off value and an external finance premium which are linear with respect to the capital-wealth ratio of each entrepreneur.¹⁶

3.4.2 Premium on External Finance and Leverage Ratio

Combining (27) and (28) and aggregating yield the following relation between the return on capital and the safe return paid on deposits:

$$R_{t+1}^k = \rho(\varpi_{t+1}) R_t \quad (29)$$

where

$$\rho(\varpi_{t+1}) = \left[\frac{(1 - \Gamma(\varpi_{t+1}))(\Gamma'(\varpi_{t+1}) - \mu M'(\varpi_{t+1}))}{\Gamma'(\varpi_{t+1})} + (\Gamma(\varpi_{t+1}) - \mu M(\varpi_{t+1})) \right]^{-1} \quad (30)$$

with $\rho'(\varpi_{t+1}) > 0$. Let's define $rp_t \equiv \frac{R_{t+1}^k}{R_t}$ as the *premium on external finance*. This ratio captures the difference between the cost of finance reflecting the existence of monitoring costs and the safe interest rate (which per se reflects the opportunity cost for the lender). By combining (25) with (30) one can write a relationship between the ex-post external finance premium, rp_t , and the capital expenditure and net worth ratio, $\frac{Q_t K_{t+1}}{NW_{t+1}}$:

¹⁶ Carlstrom and Fuerst (1997), Bernanke, Gertler and Gilchrist (1999).

$$\frac{R_{t+1}^k}{R_t} = rp_t\left(\frac{Q_t K_{t+1}}{NW_{t+1}}\right) \quad (31)$$

with $rp'\left(\frac{Q_t K_{t+1}}{NW_{t+1}}\right) > 0$ ¹⁷. An increase in net worth or a decrease in the leverage ratio reduces the optimal cut-off value, as shown by equation (24). By reducing the size of the default space it also reduces the size of the monitoring cost and the external finance premium. Equation (31) can also be written in terms of borrowing limits:

$$L_t = NW_t[rp_t^{-1}\left(\frac{R_{t+1}^k}{R_t}\right) - 1] \quad (32)$$

3.4.3 Net Worth Accumulation

Aggregate net worth at the end of period t is proportional to the realization of capital income:

$$NW_{t+1} = \varsigma(1 - \Gamma(\varpi_{t+1}))\mathcal{Y}_t^k K_t \quad (33)$$

By lagging (25) of one period and combining with (33) one can describe the evolution between period t and $t + 1$ of aggregate nominal net worth as:

$$\begin{aligned} NW_{t+1} &= \varsigma R_t^k Q_{t-1} K_t \\ &\quad - \varsigma \left(R_t + \frac{\mu M(\varpi_t) R_t^k Q_{t-1} K_t}{Q_{t-1} K_t - NW_t} \right) (Q_{t-1} K_t - NW_t) \end{aligned} \quad (34)$$

where $\frac{\mu M(\varpi_t) R_t^k Q_{t-1} K_t}{Q_{t-1} K_t - NW_t}$ is the ex-ante external finance premium which augments the nominal safe return on deposits R_t and which is required by the bank to cover the monitoring costs. We can then rewrite the net worth accumulation equation as follows:

$$NW_{t+1} = \varsigma [R_t^k Q_{t-1} K_t - \left(R_t + rp_{t-1}\left(\frac{Q_{t-1} K_t}{NW_t}\right) \right) (Q_{t-1} K_t - NW_t)] \quad (35)$$

3.5 Demand Aggregation

The final good X is obtained by assembling domestic and imported intermediate goods via the aggregate production function:

$$X_t = \left((1 - \gamma)^{\frac{1}{\eta}} X_{H,t}^{\frac{\eta-1}{\eta}} + \gamma^{\frac{1}{\eta}} X_{F,t}^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}} \quad (36)$$

¹⁷The specific form of this relation depends upon assumptions on the probability distribution of idiosyncratic shocks. Necessary and sufficient conditions to the uniqueness of the solution for the cut-off value, ϖ , require a probability distribution featuring a decreasing hazard rate - i.e. a uniform or a lognormal. Here I assume a lognormal distribution.

where $X_{H,t} \equiv \left(\int_0^1 X_{H,t}(i)^{\frac{\vartheta-1}{\vartheta}} di \right)^{\frac{\vartheta}{\vartheta-1}}$ and $X_{F,t} \equiv \left(\int_0^1 X_{F,t}(i)^{\frac{\vartheta-1}{\vartheta}} di \right)^{\frac{\vartheta}{\vartheta-1}}$ are composite aggregates of domestic and imported intermediate goods respectively. The composite final good can be then used for consumption and investment. Optimal demand for each variety of the final good are given by¹⁸:

$$X_{H,t}(i) = \left(\frac{P_{H,t}(i)}{P_{H,t}} \right)^{-\vartheta} X_{H,t}; \quad X_{F,t}(i) = \left(\frac{P_{F,t}(i)}{P_{F,t}} \right)^{-\vartheta} X_{F,t} \quad (37)$$

$$X_{H,t} = (1 - \gamma) \left(\frac{P_{H,t}}{P_t} \right)^{-\eta} X_t; \quad X_{F,t} = \gamma \left(\frac{P_{F,t}}{P_t} \right)^{-\eta} X_t \quad (38)$$

where $P_{H,t} \equiv \left(\int_0^1 P_{H,t}(i)^{\frac{\vartheta}{\vartheta-1}} di \right)^{\frac{\vartheta-1}{\vartheta}}$, $P_{F,t} \equiv \left(\int_0^1 P_{F,t}(i)^{\frac{\vartheta}{\vartheta-1}} di \right)^{\frac{\vartheta-1}{\vartheta}}$, $P_t \equiv [(1 - \gamma)P_{H,t}^{1-\eta} + \gamma P_{F,t}^{1-\eta}]^{\frac{1}{1-\eta}}$ are the respective price indices.

3.6 Production and Pricing of Intermediate Goods

Each domestic household owns an equal share of the intermediate-goods producing firms. Each of these firms assembles labor (supplied by the workers) and entrepreneurial capital to operate a constant return to scale production function for the variety i of the intermediate good:

$$Y_t(i) = A_t F(N_t(i), K_t(i)) \quad (39)$$

where A_t is a productivity shifter common to all entrepreneurs. Each firm i has monopolistic power in the production of its own variety and therefore has leverage in setting the price. In so doing it faces a quadratic resource cost of adjusting prices equal to:

$$\kappa_t(i) = \frac{\omega_p}{2} \left(\frac{P_{H,t}(i)}{P_{H,t-1}(i)} - 1 \right)^2$$

where the parameter ω_p measures the degree of nominal price rigidity. The higher ω_p the more sluggish is the adjustment of nominal prices. In the particular case of $\omega_p = 0$ prices are flexible. The problem of each domestic monopolistic firm is the one of choosing the sequence $\{K_t(i), N_t(i), P_{H,t}(i)\}_{t=0}^{\infty}$ in order to maximize expected discounted real profits:

$$E_0 \left\{ \sum_{t=0}^{\infty} \beta^t U_{c,t} \frac{\Theta_t}{P_{H,t}} \right\} \quad (40)$$

subject to the constraint:

$$Y_t(i) = A_t F(N_t(i), K_t(i)) \geq \left(\frac{P_{H,t}(i)}{P_{H,t}} \right)^{-\vartheta} X_t^W \quad (41)$$

¹⁸Optimal demands are derived solving the following maximization: $\{X_{H,t}(i), X_{F,t}(i)\}_{t=0}^{\infty}$ to maximize $P_t X_t - \int_0^1 P_{H,t}(i) X_{H,t}(i) di - \int_0^1 P_{F,t}(i) X_{F,t}(i) di$.

where $\Theta_t \equiv P_{H,t}(i)Y_t(i) - (W_t N_t(i) + Z_t K_t(i)) - P_{H,t}\varkappa_t(i)$ ¹⁹ and where $X_t^W \equiv X_{H,t} + X_{H,t}^*$ is world demand for the domestic intermediate variety i . Since adjustment costs are symmetric across firms and since ultimately all firms will charge the same price we can impose symmetry conditions. Let's denote by $\{mc_t\}_{t=0}^\infty$ the sequence of lagrange multipliers on the constraint (41) and by $\tilde{p}_{H,t} \equiv \frac{P_{H,t}(i)}{P_{H,t}}$ the relative price of variety i . The first order conditions of the above problem read as follows:

$$\frac{W_t}{P_{H,t}} = mc_t A_t F_{n,t} \quad (42)$$

$$\frac{Z_t}{P_{H,t}} = mc_t A_t F_{k,t} \quad (43)$$

$$\begin{aligned} 0 = & U_{c,t} X_t^W \tilde{p}_{H,t}^{-\vartheta} ((1 - \vartheta) + \vartheta mc_t) - U_{c,t} \omega_p \left(\pi_{H,t} \frac{\tilde{p}_{H,t}}{\tilde{p}_{H,t-1}} - 1 \right) \frac{\pi_{H,t}}{\tilde{p}_{H,t-1}} \\ & + \beta U_{c,t+1} \omega_p \left(\pi_{H,t+1} \frac{\tilde{p}_{H,t+1}}{\tilde{p}_{H,t}} - 1 \right) \pi_{H,t+1} \frac{\tilde{p}_{H,t+1}}{\tilde{p}_{H,t}^2} \end{aligned} \quad (44)$$

where $\pi_{H,t} \equiv \frac{P_{H,t}}{P_{H,t-1}}$ is the gross inflation rate. Notice that the lagrange multiplier mc_t plays the role of the *real* marginal cost of production.

3.7 The Equilibrium Conditions

I focus attention on a *symmetric* equilibrium where all domestic producers charge the same price. This implies that

$$\tilde{p}_{H,t} = 1, \text{ for all } t \quad (45)$$

In such an equilibrium equation (44) will simplify to:

$$\begin{aligned} U_{c,t} (\pi_{H,t} - 1) \pi_{H,t} = & \beta E_t \{ U_{c,t+1} (\pi_{H,t+1} - 1) \pi_{H,t+1} \} \\ & + U_{c,t} A_t F(.) \frac{\vartheta}{\omega_p} \left(mc_t - \frac{\vartheta - 1}{\vartheta} \right) \end{aligned} \quad (46)$$

The world net supply of bonds is zero. Market clearing for domestic variety i must satisfy:

$$\begin{aligned} Y_t(i) = & X_{H,t}(i) + X_{H,t}^*(i) + \varkappa_t(i) + U_t(i) K_t(i) \\ = & \left(\frac{P_{H,t}(i)}{P_{H,t}} \right)^{-\vartheta} \left[\left(\frac{P_{H,t}}{P_t} \right)^{-\eta} (1 - \gamma) X_t + \left(\frac{P_{H,t}^*}{P_t^*} \right)^{-\eta} \gamma^* X_t^* \right] + \varkappa_t(i) + U_t K_t(i) \end{aligned} \quad (47)$$

¹⁹ Under the assumption of Cobb-Douglas production technology it is possible to show that the term $(W_t N_t + Z_t K_t)$ is equal to the marginal cost for firms.

for all $i \in [0, 1]$ and t . Where $U_t = \mu M(\varpi_t) R_t^k Q_{t-1}$ and represents an output loss due to the presence of monitoring costs. Plugging (47) into the definition of aggregate output $Y_t \equiv \left[\int_0^1 Y(i)^{1-\frac{1}{\vartheta}} di \right]^{\frac{\vartheta}{\vartheta-1}}$ and recalling that $P_{H,t} = e_t P_{H,t}^*$ we can express the resource constraint as:

$$Y_t = \left(\frac{P_{H,t}}{P_t} \right)^{-\eta} (1 - \gamma) X_t + \left(\frac{P_{H,t}}{e_t P_t^*} \right)^{-\eta} \gamma^* X_t^* + \frac{\omega_p}{2} (\pi_{H,t} - 1)^2 + \mu M(\varpi_t) R_t^k Q_{t-1} K_t \quad (48)$$

For the foreign country a similar condition holds. Market clearing in the final good sector for both countries implies:

$$X_t = C_t + I_t + C_t^e \quad (49)$$

$$X_t^* = C_t^* + I_t^* + C_t^{*e} \quad (50)$$

Finally the real demand for loan has to be equal to the real supply of loans for both countries:

$$D_t = L_{t+1}; D_t^* = L_{t+1}^* \quad (51)$$

3.8 The Monetary Policy Regimes

Currency Area. I assume a *unified monetary policy* that sets the nominal interest rate endogenously. Since the model is tailored for the euro area I assume that the monetary authority targets a weighted average of CPI inflation rates and output in the area:

$$R_t^n = (R_{t-1}^n)^\chi \left(\frac{\pi_t + \pi_t^*}{2} \right)^{b_\pi} \left(\frac{y_t + y_t^*}{2} \right)^{b_y} m_t \quad (52)$$

where $R_t^n = R_t \frac{P_{t+1}}{P_t}$ and b_π is the weight that the monetary authority puts on the deviation of CPI inflation and is set equal to 1.5. m_t is a temporary monetary policy shock. Following recent estimates by Smets and Wouters (2003) I set $b_y = 0.5$. In addition following Clarida, Gali' and Gertler (2000) and Rotemberg and Woodford (1997) I assume that monetary policy applies a certain degree χ of interest rate smoothing. Aside from being consistent with most evidence on monetary policy rules the interest rate smoothing helps to generate more persistent effect of monetary policy shocks.

Independent Policies. To assess the role of the EMU I will compare the results of the model for the currency area with the ones arising under a regime of independent monetary policies that target their respective CPI indices:

$$R_t^n = (R_{t-1}^n)^\chi ((\pi_t)^{b_\pi})^{1-\chi} (y_t)^{b_y} m_t; R_t^{n*} = (R_{t-1}^{n*})^\chi ((\pi_t^*)^{b_\pi})^{1-\chi} (y_t^*)^{b_y} m_t^* \quad (53)$$

I assume the two rules being perfectly symmetric and the monetary shocks being symmetric and correlated as well.

Unilateral Peg. Finally I examine the comparison between a currency area and a unilateral currency peg. In the first case both regions agree to delegate the monetary policy to a common

monetary authority. In the second case the home region sets the nominal interest rate by targeting its own CPI inflation rate while the foreign region sets the nominal interest rate equal to the one of the home region. This outcome is also achieved under the assumption that the foreign monetary authority follows a rule of the type:

$$R_t^{n*} = (R_{t-1}^{n*})^\chi ((\pi_t^*)^{b_\pi})^{1-\chi} ((y_t^*)^{b_y})^{1-\chi} (e_t)^{\frac{b_e}{1-b_e}} m_t^* \quad (54)$$

and with a coefficient $b_e = 0.99$. In other words I assume that the foreign monetary authority applies an infinite weight on the exchange rate variability²⁰.

4 Calibration

The model is parametrized as indicated in tables (2) and (3). The countries are symmetric in all respect but differ in their financial systems. Time is measured in quarters.

Preferences. I set the workers' discount factor $\beta = 0.99$, so that the annual interest rate is equal to about 4 percent. I assume that the per-period utility takes the following form: $\frac{C_t^{1-\sigma}}{1-\sigma} + \frac{N_t^{1+\tau}}{1+\tau}$. I set the elasticity of substitution between domestic and foreign goods η equal to 1.5 as in Backus, Kehoe and Kydland (1992). The parameter on consumption in the utility function is set equal to 1.0 to ensure a steady state balanced growth path. The parameter on labor in the utility function, τ , is set equal to 2. I set the steady state ratio of exports over GDP, γ , equal to 0.2, a value compatible with data for euro area countries - i.e. see Kollmann (2004). Finally, I assume that the steady state net asset position is symmetric between the two countries. Following Schmitt-Grohe and Uribe (2002) and consistently with Lane and Milesi-Ferretti (2002) I set the elasticity of the spread on foreign bonds to the net asset position equal to 0.000742.

Production. The share of capital in the production functions, α , is equal to 0.3. The quarterly depreciation rate, δ , is set equal to 0.03. Following Basu and Fernald (1997), I set the value added mark-up of prices over marginal cost equal to 0.2. This generates a value for the price elasticity of demand, ϑ , of 6. Given the assigned value for the price mark-up and consistently with the Sbordone (1998) estimates of the elasticity to marginal cost in the Phillips curve I set the price adjustment cost parameter equal to $\omega_p = 17.5$. The adjustment cost parameter on investment has been set to 1.2. The latter has been chosen so as to generate a volatility of investment higher than the volatility of consumption as observed in the data. In order to test the robustness of the results, checks have been performed on several alternative parameter combinations. The results remain essentially unchanged.

Financial frictions parameters. The asymmetries between the two countries are built assuming three different financial scenarios for the foreign country given one particular scenario for the home country. The differences in financial structures are calibrated so as to correspond to the four largest countries of the euro area - i.e. Germany, France, Italy and Spain -. For these countries

²⁰See also Monacelli (2004).

I calculate historical averages over the last ten years of the spread between lending rates on all outstanding loans and money market rates with maturity up to one year. I obtain a value of 450 basis points for Germany, of 350 basis points for France, of 250 basis points for Italy and 140 basis points for Spain, all at annual rate²¹. These measures correspond to the external finance premium of the theoretical model. I then calibrate the home country using data for Germany, which is the largest country of the euro area and its monetary anchor, and I set the foreign country under three alternative scenarios which correspond respectively to the calibration for France, Italy and Spain²². Clearly those scenarios correspond to an increase in financial distance with respect to Germany.

Shocks. I simulate the model under monetary policy and productivity shocks.

The monetary policy shock, m_t , is assumed to have zero persistence. Volatility and cross-correlation of the shocks are calibrated using data for monetary policy shocks of individual euro area countries²³. For the independent policy regime the standard deviations of the shocks is set to 1,0007 percent and the cross-correlation to 0.5. In the currency area regime the standard deviation of the single monetary policy shock is set to 1,0007 percent.

The productivity shock is calibrated using the value obtained in Smets and Wouters (2003) who estimate a dynamic general equilibrium model for the euro area. Hence volatility of the technology shock is set to 0.006, persistence of the technology process is set to 0.9, while cross-correlation is set to 0.258.

[Table (2) about here]

[Table (3) about here]

5 Quantitative Results under Different Monetary and Financial Regimes

In this section I explore the implications of the model along two dimensions. First, I compare the transmission mechanism across different scenarios concerning the structures of the financial sectors. Second, I also compare, for each financial regime, the transmission mechanism arising in a currency area with that arising under our two alternative monetary arrangements: an independent monetary

²¹Data show that there has not been convergence in financial structures over the last years. Indeed the dispersion in the external finance premium across countries has been of 1.87 in the last decade and of 1.27 in the previous decade.

²²In the model the external finance premium is obtained as solution to a costly state verification contract which depends on a set of primitive parameters - i.e. the survival probability of firms, the monitoring cost and the volatility of idiosyncratic shock. I set the survival probability of firms to 0.97 so as to generate an annual default probability of firms of 5.6%. The latter value is compatible with both empirical and theoretical studies for industrialized countries. I then set the monitoring cost and the volatility of the idiosyncratic shock so as to generate the numbers obtained in the data for the external finance premia. The latter are in turn determinants of the sensitivity of the external finance to the collateral conditions.

²³Data on monetary policy shocks are obtained as residuals from the VAR estimated in Mojon and Peersman (2000). Their identification procedure is particularly suitable in our case since it allows for differences in monetary policy regimes across countries.

policy regime and a unilateral credible peg.

Central bank preferences are assumed to be the same in all cases. In the currency area, the common monetary authority sets the interest rate so as to target the area-wide CPI inflation, i.e. a simple average of the inflation rates in the two countries (assumed equal). Under independent policies, each monetary authority targets its own CPI inflation rate. Under a unilateral peg, the home country targets its own inflation rate, while the foreign one pegs its exchange rate which requires setting its nominal interest rate equal to the one of the home country. Finally I assume that under the independent policy regime two symmetric and correlated monetary shocks hit the nominal interest rates set by each monetary authority, while under the unilateral peg I assume an idiosyncratic monetary shock affecting the home region. In all cases productivity shocks are set as described in the calibration section.

5.1 Currency Area

Before examining the model statistics it is instructive to consider the impulse responses to monetary policy shocks only. This illustrates the properties of the monetary transmission mechanism of the present model. Figures (1) and (2) show, for the home and the foreign countries respectively, impulse responses to a common monetary policy shock under the three financial scenarios. In each case the home country is parametrized as in the first column of table (3), while the parametrization for the foreign country is moved from scenario 1 to scenario 3 of the same table. This comparison allows to explore the effects of an increase in the financial distance.

In both countries a monetary expansion reduces the nominal interest rate, inducing a decrease in the cost of the loan and an increase in investment demand. The net worth of firms increases, both due to the jump reduction in the interest rate, and following the increase in investment, thereby inducing a decrease in the external finance premium. The consequent increase in credit availability induces further increase in investment demand, hence amplifying the initial positive boost in capital spending. Those effects are analogous to the ones present in the “financial accelerator” literature in closed economies²⁴. Here, however, two further dimensions come about, due to the open economy context. First, due to financial heterogeneity a differential transmission mechanism arises in response to the common monetary policy shock. Second, due to the differentiation in production opportunities there are capital flights toward the region with the more profitable investment opportunities despite the absence of asymmetric shocks to productivity.

In particular when moving from the first to the third scenario the foreign country experiences a lower increase in investment demand and net worth while the domestic one experiences an opposite effect albeit small. The reason is that in a currency area the two national economies face different borrowing conditions due to the different riskiness of investment projects, hence different marginal productivity of capital and production structures. Capital flows occur towards countries

²⁴See Bernanke, Gertler and Gilchrist (1999), Kiyotaki and Moore (1997), Carlstrom and Fuerst (1997).

characterized by higher sensitivity of the investment demand in response to decrease in the cost of loans - the home country in our case. Hence, as one moves from the first to the third scenario there are increasing capitals flows from the foreign to the home country. A current account worsening at home mirrors an appreciations in the terms of trade. Furthermore, there is a differential effect on domestic and foreign inflation, hence leading to an inflation differential. Given the increase in aggregate demand in both countries, both domestic and foreign inflations increase; however the foreign inflation is more volatile than the domestic one.

Table (4) shows cross-correlations²⁵ of output, investment, consumption, employment, price of capital and inflation in response to the common monetary policy shock and to symmetric and correlated productivity shocks. All the correlations are positive but decreasing when moving from scenario 1 to scenario 3. In other words co-movements decrease when financial distance increases. Table (4) also shows second moments of output, investment, consumption, employment and price of capital. Volatilities of investment and the price of capital for the foreign country decrease as one moves from scenario one to scenario 3, while the opposite occurs for the volatility of consumption and employment.

5.2 Independent monetary policies

Figures (3) and (4) show impulse responses to symmetric and correlated monetary policy shocks respectively for home and foreign variables under the independent policies regime and assuming the same three financial scenarios. As before, in each case the home country is parametrized as in the first column of table (3), while the parametrization for the foreign country is moved from scenario 1 to scenario 3 of the same table.

The transmission mechanism is qualitatively similar to the one experienced by the currency area. However, in this case the differential responses are more pronounced. This is because in this case not only the external finance premium but also the risk-free component of the interest rate differ across regions, due to the independent and endogenous response of the regional monetary authorities.

Table (5) shows cross-correlations of output, investment, consumption, employment, price of capital and inflation in response to symmetric and correlated monetary policy and productivity shocks. As before co-movements decrease when financial distance increases. However, now all correlations are lower than under the currency area regime. The table also shows second moments of output, investment, consumption, employment and price of capital. The pattern of volatilities across scenarios is very similar to the one observed in the currency area regimes except that now

²⁵Given the reduced form of the log-linearized model $E\{X_t\} = AX_{t-1} + b\varepsilon_t$, where X_t is the matrix of the endogenous variables, A is the transition matrix and ε_t is the vector of the exogenous shocks and given the variance covariance matrix of shocks, $\Psi = b * \Sigma_\varepsilon * b'$, the second moments matrix, Ω , for the endogenous variables is given by $\Omega_{as} = \lim_{k \rightarrow \infty} \{\sum_{i=0}^k (A^i)\Psi(A^i)'\}$. The numbers reported in the tables have been calculated by approximating Ω_{as} by Ω_{k+1} so that the $\max[\Omega_{k+1} - \Omega_k] \geq 1.0e - 0.8$, with \max being the maximum distance between any two elements of the matrix $\Omega_{k+1} - \Omega_k$.

all values are slightly lower.

5.3 Unilateral peg

I now examine the case where a country unilaterally decides to peg its exchange rate to another country, thereby adopting its monetary policy. What makes this case interesting is the fact that such regime was adopted as an intermediate step by a number of countries wishing to join the European currency area later. Most of these countries were small and relatively open. In the 1990s, examples of countries opting for a unilateral peg before joining EMU were the Netherlands and Austria. Presently, unilateral hard pegs are in force e.g. in Estonia (which follows a currency board with the euro) and Slovenia (which unilaterally euroised), both of which plan to become full euro area members within this decade. The key difference between this regime and the currency area is that the domestic monetary authority targets its own inflation rate, while disregarding that of the foreign country, whereas in the currency area the target inflation rate is an average of the two inflation rates. I assume that the unilateral currency peg is fully credible – this is a key assumption, to which I will return later. Against this background, the question I ask is how the macroeconomic outcomes under this peg compare with those resulting from a currency area regime. To make the experiment more realistic I assume that the foreign country - the one pegging the exchange rate - has a higher degree of openness ($\gamma^* = 0.4$) than the home country ($\gamma = 0.2$).

Figure (5) shows impulse responses of home and foreign variables under the usual three financial scenarios and assuming a positive monetary policy shock at home. The key finding is that under this arrangement the dynamic pattern of variables in the two regions is very similar to the one that arises under the currency area regime (though obviously not identical). Table (6) shows cross-correlations and second moments of output, investment, consumption, employment, price of capital and inflation and second moments for output, investment, consumption, employment and asset price in both countries in response to a domestic monetary policy shocks and to symmetric and correlated productivity shocks. As before co-movements decrease when financial distance increases. The values of all correlations are basically equal to the ones that arise under the currency area regime. Volatilities are also very similar to the ones of the currency area²⁶. Notice that the volatility of the terms of trade in this case is slightly lower than the one obtained under the currency area regime. This shows that under the unilateral peg the inflation differentials between the two regions are very small.

The similarity between the quantitative properties of the two alternative regimes depends on the fact that in this experiment the inflation rate gap between the two countries is not large enough to produce different results depending on whether the monetary policy targets the home country inflation only or a combination of the two inflation rates. All this critically hinges on the assumption of full credibility of the hard peg. The expected future exchange rate remains fixed under a peg

²⁶This similarity holds even if we reverse the experiment and assume that the country pegging the exchange rate is financially more fragile than the home country.

only if the announced policy is credible. In practice, however, as shown by many cases of failed currency pegs, credibility cannot be assured. A single currency area is the only arrangement that makes exchange rates irrevocable in a credible way.

5.4 Summary of model results

The results in this section can be summarized as follows:

Result 1: For each monetary regime, the cyclical co-movements across countries decrease when the financial distance increases.

Result 2: In presence of structural differences in financial markets, regional co-movements are higher in the case in which the two countries share the same monetary policy than when each one retains its own independent policy.

Result 3: Under a unilateral peg, with different degree of trade openness, business cycle co-movements are broadly similar to those experienced under a currency area.

6 Comparing Model Predictions with the Data

The last step is to match the predictions of the model with the observed co-movements of the economic cycles. We first look at our four euro area countries (Germany, France, Italy, Spain), before and after EMU. Then, for comparison, we will look at the US and the UK. These two countries are useful control cases since they are large trading partners of the four countries, and have not adopted the euro nor pegged to it. As proxies of the business cycle I will consider four variables: output, private consumption, gross private capital formation and total employment²⁷.

6.1 Euro area countries

The sample periods are chosen so as to strike a balance between the need of keeping the sample size sufficiently long in the post-EMU period (for the earlier period no data limitations exist), and that of properly measuring the correlations after the introduction of the euro. My sample for the second period starts in 1997, thus including two years before the actual launch of the euro, based on the fact that in these two years monetary policy among the future euro area members was closely in line²⁸. The two samples are then: pre-EMU: 1971-1996; post-EMU: 1997-2004Q1. All data are in logs and de-trended using a Hodrick Prescott filter²⁹. The business cycle correlations are calculated between the de-trended variables for Germany and the corresponding ones for each of the other three countries – France, Italy and Spain.

Table (7) shows the correlations obtained from the data and the corresponding ones from the model. The model correlations for the independent policy regime and the currency area regimes

²⁷I do not consider the evolution of labor hours simply because these data are not available for European countries.

²⁸See Angeloni and Dedola (1999).

²⁹The filter has been applied on data ranges which cover at least one cycle.

are compared respectively with empirical cross-correlations for the pre-EMU and the post-EMU period.

The comparison shows that the model is quite successful in matching the data. First, in both the data and the model there is a clear tendency for the correlations to increase when moving from the independent policy regime (pre-EMU) to the currency area regime (post-EMU), for each level of financial distance, and to decrease with the increase of the financial distance, for each policy regime. This is the main qualitative prediction of the model and is matched by the data very closely. Second, also the absolute levels of the correlations and the size of their changes when moving across regimes are not dissimilar between the model and the data. Consider, for example, the increase in correlation when moving from independent policies to the currency area (the column labelled as “Regime differences” reported in the right-hand side of the table (7)). For the Germany-France pair, the increase from the data is 0.17, 0.41 and 0.24 respectively for output, investment and consumption, against 0.27, 0.37 and 0.11 predicted by the model. A summary measure of the model’s ability to explain the increase in cyclical co-movements when moving from the pre-EMU to the post-EMU regime can be given by the simple average of the correlations increases for this three variables. The simple average of the three is 0.27 vs. 0.25 (see Table (8)), which suggests that the model explains on average 91 percent of the increases in correlation that occurs in these three expenditure components when one moves from independent monetary policies to a common currency under scenario 1 (Germany versus France). The result is similar for the Germany-Italy pair (0.24 vs. 0.21, or 90 percent), and somewhat worse for the Germany-Spain pair (0.41 vs. 0.19, or 46 percent). Interestingly, the data matching is significantly less good for employment, a variable for which the model systematically over-predicts the increase in correlation occurred between the pre-EMU and the post-EMU periods. On reflection this does not come as a surprise, however, if one considers that the model calculates employment around a full employment steady state, whereas all four countries have enacted, in the transition between the pre-EMU and the post-EMU regimes, labor market policies that have changed their structural employment levels.

The other dimension along which the table results are interesting is by column, i.e. when one considers changes in the financial distance for any given type of monetary regime. The differences between the country pairs are reported in the lower section of the table (7) in the column labelled as “Countries/scenarios differences”. Consider again the average of the differential correlations of output, investment and consumption (lower section of Table (8)). One sees that the historical data predict a decrease in correlation, when the financial distance rises from the first scenario (Germany vs. France) to the second (Germany vs. Italy) of 0.06 in the pre-EMU and of 0.10 in the post-EMU. The model counterparts are 0.05 and 0.08. Between the first and the third scenario the match is very good for the post-EMU period (0.13 in the data vs. 0.15 in the model), but not so good in the pre-EMU period (0.27 in the data against 0.09 in the model); this is conceivably due to the fact that, before EMU, the monetary policy was much less tightly coordinated between Germany

and Spain than it was between Germany and the other two countries³⁰.

Note further that the changes in the correlations between the first and the second scenarios are small relative to the ones between the first and the third scenarios, both in the data and in the model, which shows that the model calibration captures the fact that the distance between France and Italy is lower than that between France and Spain.

In conclusion: the model is quite successful in mimicking the changes in the patterns of business cycle correlations among the four main euro area countries. Specifically, the model's prediction that cyclical correlation would increase when moving from autonomous monetary policy to a currency area, and decrease with the increase of the financial distance, correspond to what observed in the data both qualitatively and quantitatively.

6.2 Control Countries: UK and US

Table (9)) shows analogous results referred to the US and the UK. Since both countries maintained floating exchange rates in both periods, the regime does not change. The model is calibrated using comparable measures of the external finance premium; given the dominant role of the corporate bond market in both countries, the premia are proxied by the spreads of B-rated corporate bonds over riskless rates of similar maturity. In the US, this premium rose between the two periods from 1.6 to 2.4 percent, in the UK between 1.0 and 1.8.

The results show a very good fit for the US: taking again the average of output, investment and consumption the correlation between the two period rises by 0.11 in the data, and by 0.08 in the model. The match is somewhat lower for the UK, 0.23 vs. 0.12. In thinking about these results one should consider that a number of other aspects have changed in the economies concerned between the two periods, besides the financial distance. In particular, most euro area countries have enacted market-friendly reforms in the labor market. The fact that these reforms are not incorporated in my model explains why the model tends to underrepresent the change in the cyclical co-movements across the two periods³¹.

7 Conclusions

The recent empirical literature has stressed, so far separately, two aspects concerning the relation between monetary policy and business cycles. First, the transmission of monetary policy depends on the country's financial structure. Second, the international transmission of shocks among open

³⁰The cross-country correlation of the estimated VAR residuals estimated by Peersman and Mojon (2002) are, for the Germany-Spain VAR, 0.08, and for the Germany-France and Germany-Italy pairs, 0.2 and 0.16 respectively. If we include this further difference in the model, the match with the data becomes almost perfect.

³¹If one considers the comparisons across countries, whose results are not reported here for brevity, the model performs equally well. For example, in pre-EMU period the model explains two thirds of the higher correlation of the Germany vs. France pair relative to the Germany vs. US pair, and about half of the higher correlation relative to the Germany vs. UK pair. Post-EMU, the corresponding percentages are 135 and 81 percent.

economies depends on the monetary policy and exchange regime.

In this paper I propose a unitary framework linking together these two areas of research. In the first part of the paper, using a standard 2-country stochastic dynamic general equilibrium model with financial accelerator I show that, first, the cyclical correlation among the main cyclical variables increases when moving from an independent monetary policy regime with floating exchange rate to a currency area, and, second, decreases if the difference in the financial structures increase. My proxy of the financial diversity is the premium paid by firms to obtain external finance. In the second part of the paper I compare the prediction of the model, calibrated to the main euro area countries (Germany, France, Italy, Spain), with the empirical correlations observed among the same countries before and after the European monetary unification, and show that the model captures well the broad features of the data.

It needs stressing that the analysis of the paper is positive, not normative. The focus was on modelling and explaining the cyclical co-movements (or lack thereof), not on analyzing their welfare implications. The latter are, however, a natural possible extension. The optimal degree of convergence and cyclical co-movement inside the euro area is an open question at this stage. A micro-founded model like the one used here could be used, for example, to answer questions on the welfare gains from different structural reforms in the financial markets.

In closing, one aspect in which the matching of the model is less than satisfactory should be mentioned, because it indicates an area where the model could be enriched in the future. The model does not make much progress, relative to the literature, towards resolving the well-known consumption-output correlation puzzle - namely the fact that empirical cross-correlations of output tend to be higher than the ones predicted by standard open economy general equilibrium models. This reflects probably the fact that borrowing constraints are operative only at the level of investment. The addition of borrowing constraints on the consumer side would presumably tend to reduce the cross-correlations of the demand components. Verifying this goes beyond the scope of this paper and is left for future research.

References

- [1] Angeloni, I. and L. Dedola, (1999), "From the ERM to the Euro : New Evidence on Economic and Policy Convergence among EU Countries", w.p. 4, European Central Bank.
- [2] Angeloni I. and M. Ehrmann, (2003), "Monetary Transmission in the Euro Area: Early Evidence", *Economic Policy*, vol. 18-37, 469-501, 10.
- [3] O. Issing, Gaspar V., Angeloni, I. and O. Tristani, (2001), *Monetary Policy in the Euro Area*, Cambridge University Press.
- [4] Angeloni, I., A. Kashyap and B. Mojon, (2003), *Monetary Policy Transmission Mechanism in the Euro Area*, Cambridge University Press.

- [5] Artis M.J. and W. Zhang, (1997), "International business cycles and the ERM: Is there a European business cycle?", *International Journal of Finance and Economics*, 2, 1-16.
- [6] Backus, D.K., P.J. Kehoe and F.E. Kydland, (1992), "International Real Business Cycles", *Journal of Political Economy*, 101, 745-775.
- [7] Basu, S. and J. Fernald, (1997), "Returns to Scale in U.S. Production: Estimates and Implications", *Journal of Political Economy*, vol. 105-2, pages 249-83.
- [8] Benigno P., (2001), "Price Stability with Imperfect Financial Integration", CEPR w. p. No. 2854.
- [9] Bernanke, B., M. Gertler and S. Gilchrist, (1999), "The Financial Accelerator in a Quantitative Business Cycle Framework", in J.B. Taylor, and M. Woodford, eds., *Handbook of Macroeconomics*, Amsterdam: North-Holland.
- [10] Calvo, G. (1983), "Staggered Prices in a Utility Maximization Framework", *Journal of Monetary Economics*, 12, 383-98.
- [11] Carlstrom, C. and T. Fuerst, (1997), "Agency Costs, Net Worth and Business Fluctuations: A Computable General Equilibrium Analysis", *American Economic Review*, 87, 893-910.
- [12] Ceccarelli, M. and A. Rebucci, (2002), "The Transmission Mechanism of European Monetary Policy: Is There Heterogeneity?" "Is It Changing Over Time?", IMF w.p. No. 02-54.
- [13] Cecchetti, S. G., (1999), "Legal Structure, Financial Structure, and the Monetary Policy Transmission Mechanism", NBER w. p. 7151.
- [14] Chari, V.V., P. Kehoe and E. R. McGrattan, (2002), "Can Sticky Price Models Generate Volatile and Persistent Real Exchange Rate", *Review of Economic Studies*, vol. 69-3, 533-63.
- [15] Clarida, R., J. Gali, and M. Gertler, (2000), "Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory", *Quarterly Journal of Economics*, 115 (1), 147-180.
- [16] Cooley T. F. and K. Nam , (1998), "Asymmetric Information, Financial Intermediation, and Business Cycles", *Economic Theory*, 12, 3.
- [17] Cooley T. and V. Quadrini, (2001), "Financial Markets and Firm Dynamics", *American Economic Review*, 91.
- [18] Faia E., (2003), "Monetary Policy in a World with Different Financial Systems", European Central Bank w.p. #183.
- [19] Gale, D. and M. Hellwig (1985), "Incentive-Compatible Debt Contracts: The One-Period Problem", *Review of Economic Studies*, 52, 647-663.

- [20] Giovannetti G. and R. Marimon, (1999), “An EMU with Different Transmission Mechanisms?”, in J. von Hagen and C. Waller (eds.) *Regional Aspects of Monetary Policy in Europe*, Kluwer Academic Publishers.
- [21] Guiso, L., A. Kashyap, F. Panetta and D. Terlizzese, (1999), “Will A Common European Monetary Policy Have Asymmetric Effects?”, Federal Reserve Bank of Chicago Economic Perspectives, 23-4, 56-75.
- [22] Heathcote, J. and F. Perri (2001), “Financial Globalization and Real Regionalization”, Stern School of Business.
- [23] Kiyotaki, N. and J. Moore, (1997), “Credit Cycles”, *Journal of Political Economy*, 105, 211-48.
- [24] Kollmann R., (2004), “Welfare Effects of a Monetary Union: the Role of Trade Openness”, forthcoming in: *Journal of the European Economic Association*.
- [25] Lane, P. R. and G. Milesi-Ferretti, (2003), “International Financial Integration”, CEPR d.p. 3769.
- [26] La Porta, R., F. Lopez-de-Silanes, A. Shleifer and R. Vishny, (1999), “Investor Protection: Origins, Consequences, Reform”, Harvard Institute of Economic Research Working Papers, Harvard - Institute of Economic Research.
- [27] La Porta, R., F. Lopez-de-Silanes, A. Shleifer and R. Vishny, (1997), “Legal Determinants of External Finance,” NBER w.p. 5879, National Bureau of Economic Research, Inc.
- [28] Mendoza E., (1991), “Real Business Cycles in a Small Open Economy”, *American Economic Review*, vol. 81, 4, 797-818.
- [29] Mihov, I., (2001), “Monetary Policy Implementation and The Transmission in the European Monetary Union”, *Economic Policy*, 33, 369-402.
- [30] Mojon, B. and G. Peersman, (2000), “A VAR Description of The Effects of Monetary Policy in The Individual Countries of The Euro Area”, in *Monetary Policy Transmission in the Euro Area*, Edited by I. Angeloni, A. K. Kashyap, B. Mojon.
- [31] Monacelli T., (2004), “Into the Mussa Puzzle: Monetary Policy Regimes and the Real Exchange Rate in a Small Open Economy”, *Journal of International Economics*, 62, 191-217.
- [32] Rotemberg, J., (1982), “Monopolistic Price Adjustment and Aggregate Output”, *Review of Economics Studies*, 44, 517-531.
- [33] Rotemberg, J. and M. Woodford, (1997), “An Optimization-Based Econometric Model for the Evaluation of Monetary Policy”, *NBER Macroeconomics Annual*, 12: 297-346.

- [34] Sbordone A., (1998), “Prices and Unit Labor Costs: A New Test of Price Stickiness”, Institute for International Economic Studies, Stockholm, s.p. n. 653.
- [35] Schmitt-Grohe S. and M. Uribe, (2003), “Closing Small Open Economy Models”, *Journal of International Economics*, 61, 163-185.
- [36] Senhadji A., (2003), “External Shocks and Debt Accumulation in a Small Open Economy”, *Review of Economic Dynamics*, 6, 1, 207-239.
- [37] Sensier, M., M. Artis, D. Osborn and C. Birchenhall, (2002), “Domestic and International Influences on Business Cycle Regimes in Europe”, Centre for Growth and Business Cycle Research Discussion Paper Series, University of Manchester, No. 11.

Table 1: **Indicators of the banking sector and of the financial conditions of firms.**

Countries	Return on Asset	Thomson rating	MC Loans*	External Finance**	Leverage***
Austria	0.37	2.38	4.22	46.00	...
Belgium	0.52	2.00	4.62	60.00	29.00
Finland	-0.08	2.83	4.24	34.00	31.00
France	0.93	0.10	4.42	49.00	30.00
Germany	0.32	1.97	4.72	58.00	87.00
Ireland	2.95	1.83	4.48	13.00	...
Italy	0.87	2.57	4.20	37.00	59.00
Netherlands	6.99	2.10	4.61	48.00	72.00
Spain	0.98	1.79	3.88	11.00	47.00

...:missing data.

*Rate applied on new loans with maturity greater than one year. Source ECB.

**This is measured as percentage of GDP.

***Percent ratio of bank debt to equity, non-financial corporate sector. Source AKM (2003).

Table 2: **Model parameters and shock calibration.**

Parameters and shocks	Mnemonics	Values
Workers Discount factor	β	0.99
Elasticity of home and foreign goods	η	1.5
Parameter on consumption utility	σ	1
Parameter on labor dis-utility	τ	3
Share of exports over GDP	γ	0.2
Elasticity of spread to bond accumulation	ζ	0.000742
Share of capital in Cobb-Douglas production	α	0.35
Capital depreciation rate	δ	0.03
Elasticity of variety demand	ϑ	6
Prices adjustment cost	ω_p	17.5
Persistence of monetary process	ρ_m, ρ_{m^*}	0
Persistence of area wide monetary shock	$\rho_{m^{EU}}$	0
Standard deviations of monetary shocks	$\sigma_m, \sigma_{m^*}, \sigma_{m^{EU}}$	1.0007%
Correlation of monetary shocks	$Corr(\varepsilon_m, \varepsilon_{m^*})$	0.5
Persistence of technology process	ρ_A, ρ_{A^*}	0.9
Standard deviation of technology shock	σ_A, σ_{A^*}	0.006
Correlation of technology shocks	$Corr(\varepsilon_A, \varepsilon_{A^*})$	0.258

Table 3: **Calibration of the financial scenarios.**

Contract parameters*	Mnemonics	Home country	Foreign country		
			Scenario 1	Scenario 2	Scenario 3
Steady state leverage ratio	$\frac{K}{NW}$	2	2	2	2
Steady state EFP	rp^{ss}	$\frac{0.045}{4}$	$\frac{0.035}{4}$	$\frac{0.025}{4}$	$\frac{0.015}{4}$
Elasticity to leverage ratio	$rp(\cdot)$	0.07	0.056	0.025	0.015
Survival probability	ς	0.97	0.97	0.97	0.97

* All parameters in the table are quarterly frequency.

Table 4: **Cross-correlations and standard deviations under three alternative financial scenarios and in response to common monetary policy shock and symmetric and correlated productivity shocks under the currency area regime.**

Model statistics	Mnemonics	Scenario 1	Scenario 2	Scenario 3
Output cross-correlation	$Corr(Y, Y^*)$	0.78	0.63	0.52
Investment cross-correlation	$Corr(I, I^*)$	0.98	0.94	0.89
Consumption cross-correlation	$Corr(C, C^*)$	0.93	0.88	0.84
Employment cross-correlation	$Corr(N, N^*)$	0.94	0.94	0.94
Asset price cross-correlation	$Corr(Q, Q^*)$	0.98	0.93	0.86
Inflation cross-correlation	$Corr(\pi, \pi^*)$	0.99	0.99	0.99
Home output st. dev.	σ_Y	2.60	2.70	2.70
Foreign output st. dev.	σ_{Y^*}	2.30	1.79	1.66
Home (investment st. dev./output st. dev.)	σ_I/σ_Y	3.24	3.27	3.28
Foreign (investment st. dev./output st. dev.)	$\sigma_{I^*}/\sigma_{Y^*}$	2.92	1.91	1.37
Home (consumption st. dev./output st. dev.)	σ_C/σ_Y	0.77	0.77	0.77
Foreign (consumption st. dev./output st. dev.)	$\sigma_{C^*}/\sigma_{Y^*}$	0.84	0.96	1.01
Home (employment st. dev./output st. dev.)	σ_N/σ_Y	0.69	0.68	0.68
Foreign (employment st. dev./output st. dev.)	$\sigma_{N^*}/\sigma_{Y^*}$	0.80	1.03	1.11
Home (asset price st. dev./output st. dev.)	σ_Q/σ_Y	2.36	2.36	2.37
Foreign (asset price st. dev./output st. dev.)	$\sigma_{Q^*}/\sigma_{Y^*}$	2.14	1.53	1.29
Terms of trade st. dev.	σ_{tot}	1.10	1.30	1.50

Table 5: Cross-correlations and standard deviations under three alternative financial scenarios and in response to common monetary policy shock and symmetric and correlated productivity shocks under the currency area regime.

Model statistics	Mnemonics	Scenario 1	Scenario 2	Scenario 3
Output cross-correlation	$Corr(Y, Y^*)$	0.51	0.42	0.35
Investment cross-correlation	$Corr(I, I^*)$	0.62	0.59	0.55
Consumption cross-correlation	$Corr(C, C^*)$	0.82	0.80	0.78
Employment cross-correlation	$Corr(N, N^*)$	0.34	0.33	0.33
Asset price cross-correlation	$Corr(Q, Q^*)$	0.64	0.62	0.57
Inflation cross-correlation	$Corr(\pi, \pi^*)$	0.50	0.39	0.30
Home output st. dev.	σ_Y	2.52	2.52	2.52
Foreign output st. dev.	σ_{Y^*}	2.22	1.77	1.65
Home (investment st. dev./output st. dev.)	σ_I/σ_Y	3.25	3.27	3.28
Foreign (investment st. dev./output st. dev.)	$\sigma_{I^*}/\sigma_{Y^*}$	2.90	1.87	1.34
Home (consumption st. dev./output st. dev.)	σ_C/σ_Y	0.75	0.73	0.77
Foreign (consumption st. dev./output st. dev.)	$\sigma_{C^*}/\sigma_{Y^*}$	0.80	0.90	0.93
Home (employment st. dev./output st. dev.)	σ_N/σ_Y	0.78	0.77	0.77
Foreign (employment st. dev./output st. dev.)	$\sigma_{N^*}/\sigma_{Y^*}$	0.88	1.12	1.20
Home (asset price st. dev./output st. dev.)	σ_Q/σ_Y	2.36	2.38	2.38
Foreign (asset price st. dev./output st. dev.)	$\sigma_{Q^*}/\sigma_{Y^*}$	2.11	1.44	1.19
Terms of trade st. dev.	σ_{tot}	1.50	1.60	1.60

Table 6: Cross-correlations and standard deviations under three alternative financial scenarios and in response to monetary policy shock and symmetric and correlated productivity shocks under the unilateral peg regime.

Model statistics	Mnemonics	Scenario 1	Scenario 2	Scenario 3
Output cross-correlation	$Corr(Y, Y^*)$	0.79	0.62	0.49
Investment cross-correlation	$Corr(I, I^*)$	0.99	0.94	0.85
Consumption cross-correlation	$Corr(C, C^*)$	0.94	0.90	0.87
Employment cross-correlation	$Corr(N, N^*)$	0.93	0.93	0.93
Asset price cross-correlation	$Corr(Q, Q^*)$	0.99	0.93	0.85
Inflation cross-correlation	$Corr(\pi, \pi^*)$	0.99	0.99	0.99
Home output st. dev.	σ_Y	2.56	2.57	2.57
Foreign output st. dev.	σ_{Y^*}	2.38	1.83	1.70
Home (investment st. dev./output st. dev.)	σ_I/σ_Y	3.33	3.35	3.36
Foreign (investment st. dev./output st. dev.)	$\sigma_{I^*}/\sigma_{Y^*}$	2.82	1.78	1.22
Home (consumption st. dev./output st. dev.)	σ_C/σ_Y	0.80	0.77	0.76
Foreign (consumption st. dev./output st. dev.)	$\sigma_{C^*}/\sigma_{Y^*}$	0.80	0.91	0.93
Home (employment st. dev./output st. dev.)	σ_N/σ_Y	0.74	0.73	0.73
Foreign (employment st. dev./output st. dev.)	$\sigma_{N^*}/\sigma_{Y^*}$	0.77	0.98	1.04
Home (asset price st. dev./output st. dev.)	σ_Q/σ_Y	2.43	2.45	2.46
Foreign (asset price st. dev./output st. dev.)	$\sigma_{Q^*}/\sigma_{Y^*}$	2.07	1.45	1.20
Terms of trade st. dev.	σ_{tot}	1.00	1.20	1.30

Table 7: **Comparison between cross-correlations generated by the model and empirical cross-correlations across regimes.**

		pre-EMU		post-EMU		Regime differences	
Countries/scenarios	Variables	Data	Model*	Data	Model	Data	Model*
Germany-France (scenario1)	Output	0.65	0.51	0.83	0.78	0.17	0.27
	Investment	0.49	0.62	0.89	0.99	0.41	0.37
	Consumption	0.47	0.82	0.67	0.93	0.24	0.11
	Employment	0.63	0.34	0.94	0.94	0.23	0.60
Germany-Italy (scenario2)	Output	0.61	0.42	0.80	0.63	0.19	0.21
	Investment	0.42	0.59	0.82	0.94	0.37	0.35
	Consumption	0.38	0.8	0.56	0.88	0.15	0.08
	Employment	0.63	0.33	0.53	0.94	-0.12	0.61
Germany-Spain (scenario 3)	Output	0.40	0.35	0.71	0.52	0.32	0.17
	Investment	0.13	0.55	0.72	0.89	0.64	0.34
	Consumption	0.26	0.78	0.54	0.84	0.28	0.06
	Employment	0.62	0.33	0.85	0.94	0.22	0.61
Countries/scenarios differences							
Scenario1-Scenario3	Output	0.25	0.16	0.1	0.26		
	Investment	0.36	0.07	0.13	0.1		
	Consumption	0.21	0.04	0.17	0.09		
	Employment	0.01	0.01	0.02	0.00		
Scenario1-Scenario2	Output	0.04	0.09	0.02	0.15		
	Investment	0.07	0.03	0.11	0.05		
	Consumption	0.09	0.02	0.18	0.05		
	Employment	0.00	0.01	0.35	0.00		

* In the model pre-emu phase corresponds to independent policies, post-emu phase to currency area

Table 8: **Differences across regimes and scenarios: average results for output investment and consumption (calculated from Table7).**

Regimes differences			
	Data	Model	Percentage explained by the model
Scenario 1	0.27	0.25	91%
Scenario 2	0.24	0.21	90%
Scenario 3	0.41	0.19	46%
Countries/scenarios differences			
	Data	Model	Percentage explained by the model
Scenario 1- Scenario 3, pre-EMU	0.27	0.09	33%
Scenario 1 - Scenario 3, post-EMU	0.13	0.15	112%
Scenario 1- Scenario 2, pre-EMU	0.06	0.05	70%
Scenario 1- Scenario 2, post-EMU	0.10	0.083	81%

Table 9: Comparison between cross-correlations generated by the model and empirical cross-correlations (US and UK).

		pre-EMU*		post-EMU*		Differences		Averages		
Countries	Variables	Data	Model	Data	Model	Data	Model	Data	Model	%
Germany-US	Output	0.54	0.39	0.50	0.48	0.35	0.17	0.11	0.08	72%
	Investment	0.42	0.58	0.70	0.62	-0.04	0.13			
	Consumption	0.36	0.79	0.44	0.82	0.37	0.05			
Germany-UK	Output	0.38	0.30	0.73	0.47	-0.04	0.09	0.23	0.12	51.47%
	Investment	0.16	0.49	0.14	0.62	0.28	0.04			
	Consumption	0.21	0.76	0.58	0.81	0.08	0.10			

* The pre and post-EMU differ due to a change in external finance premium

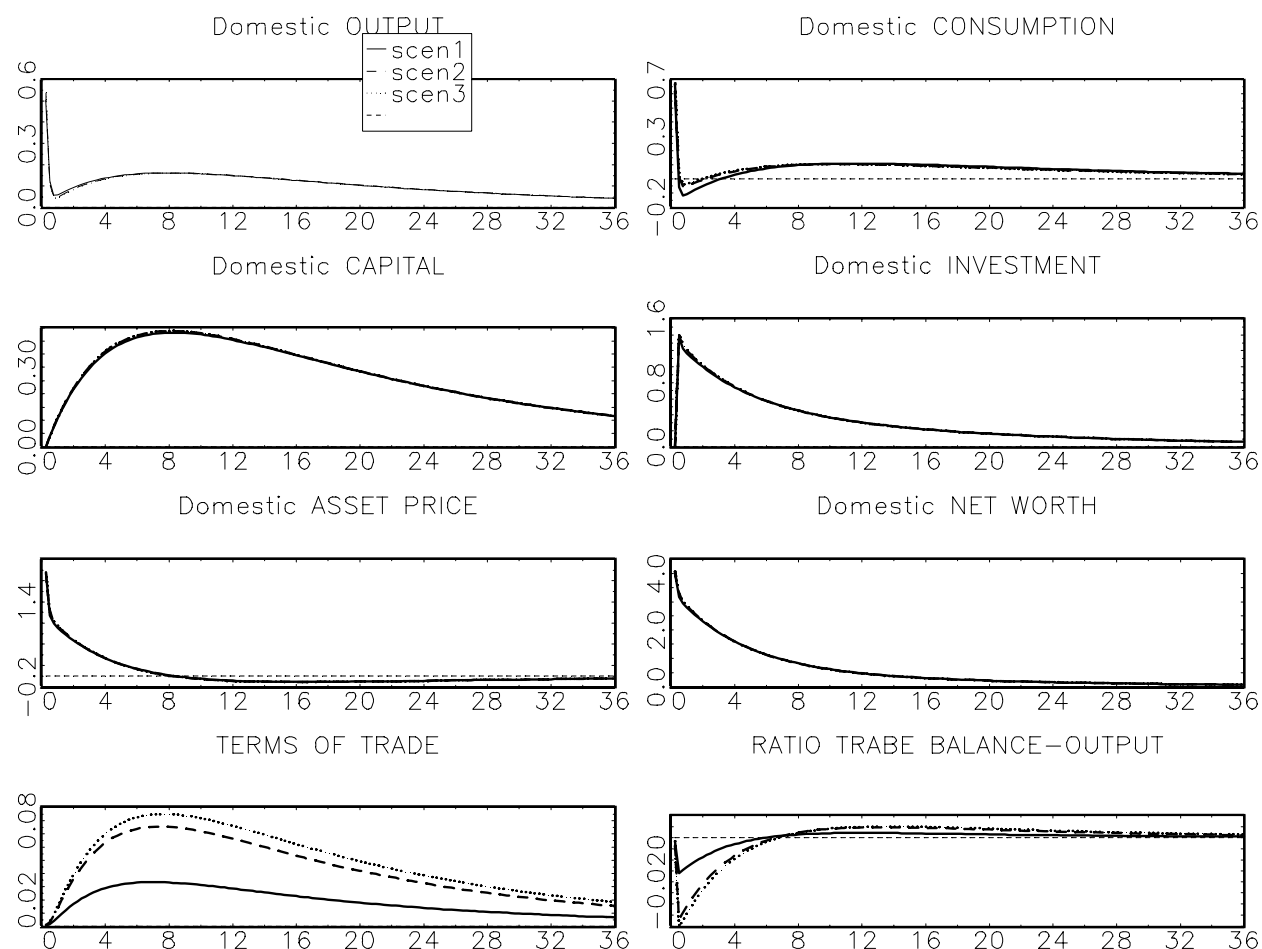


Figure 1: Impulse responses of domestic variables. Common monetary policy shock under currency area regime.

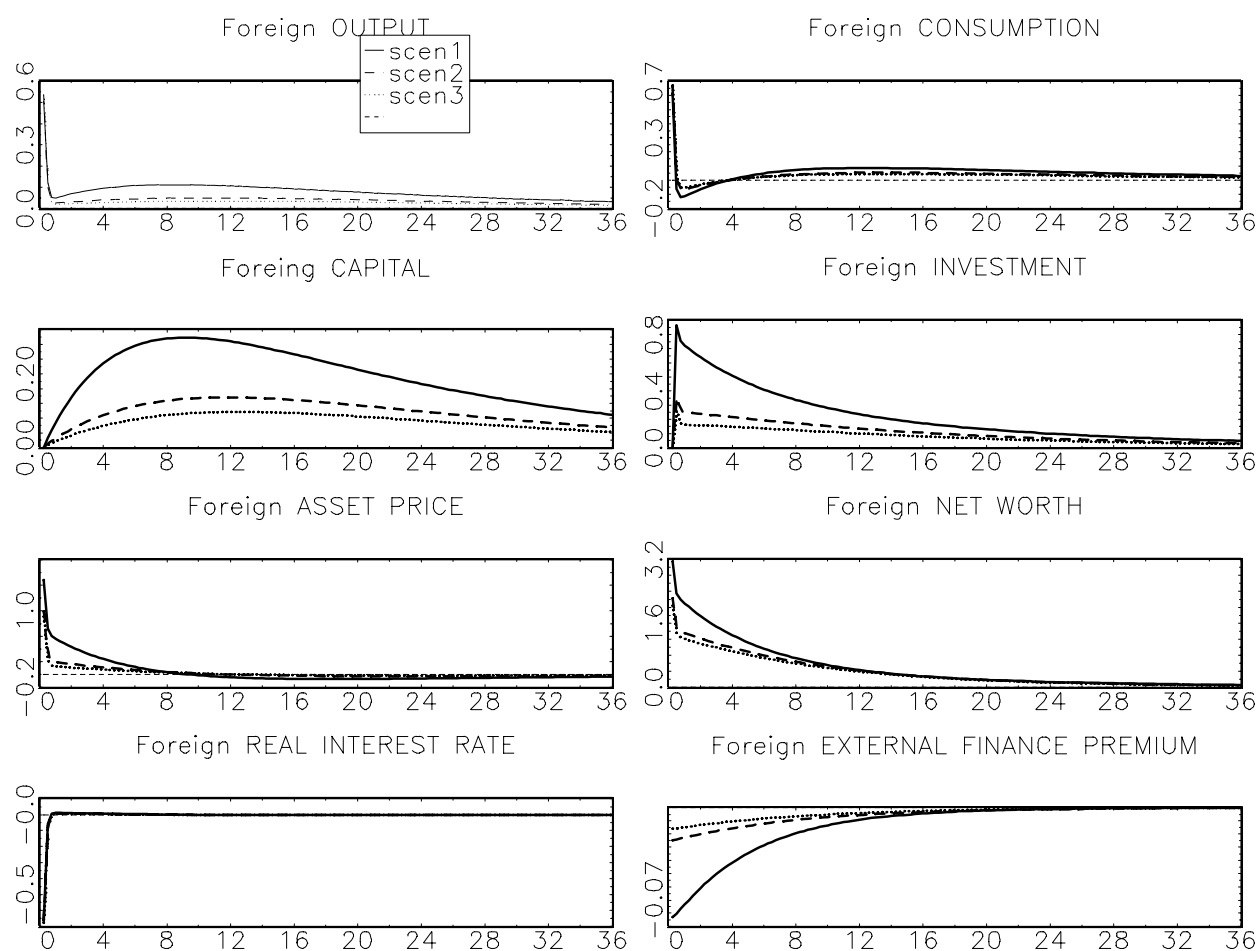


Figure 2: **Impulse responses of foreign variables. Common monetary policy shock under currency area regime.**

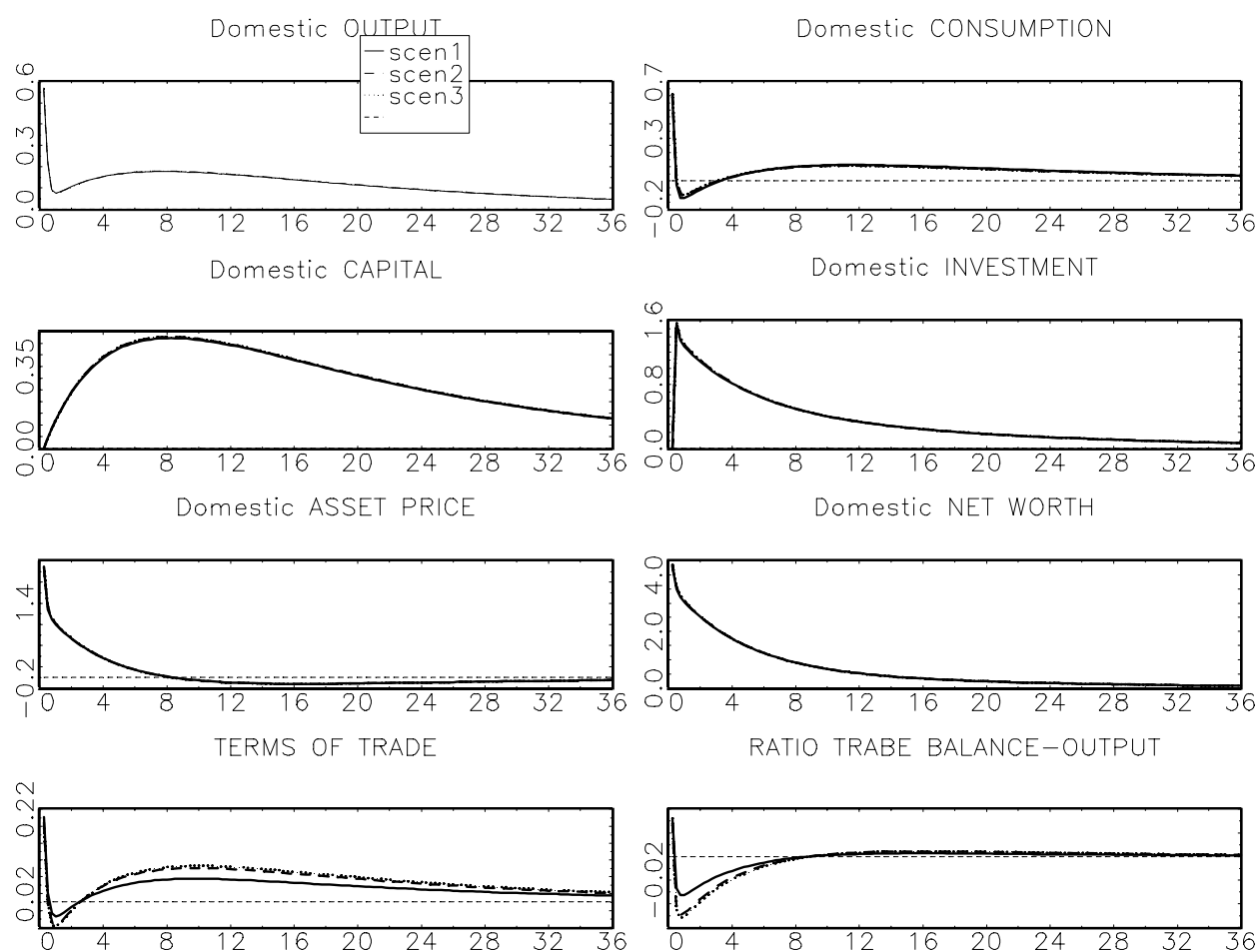


Figure 3: **Impulse responses of domestic variables. Symmetric and correlated monetary policy shocks under independent policies regime.**

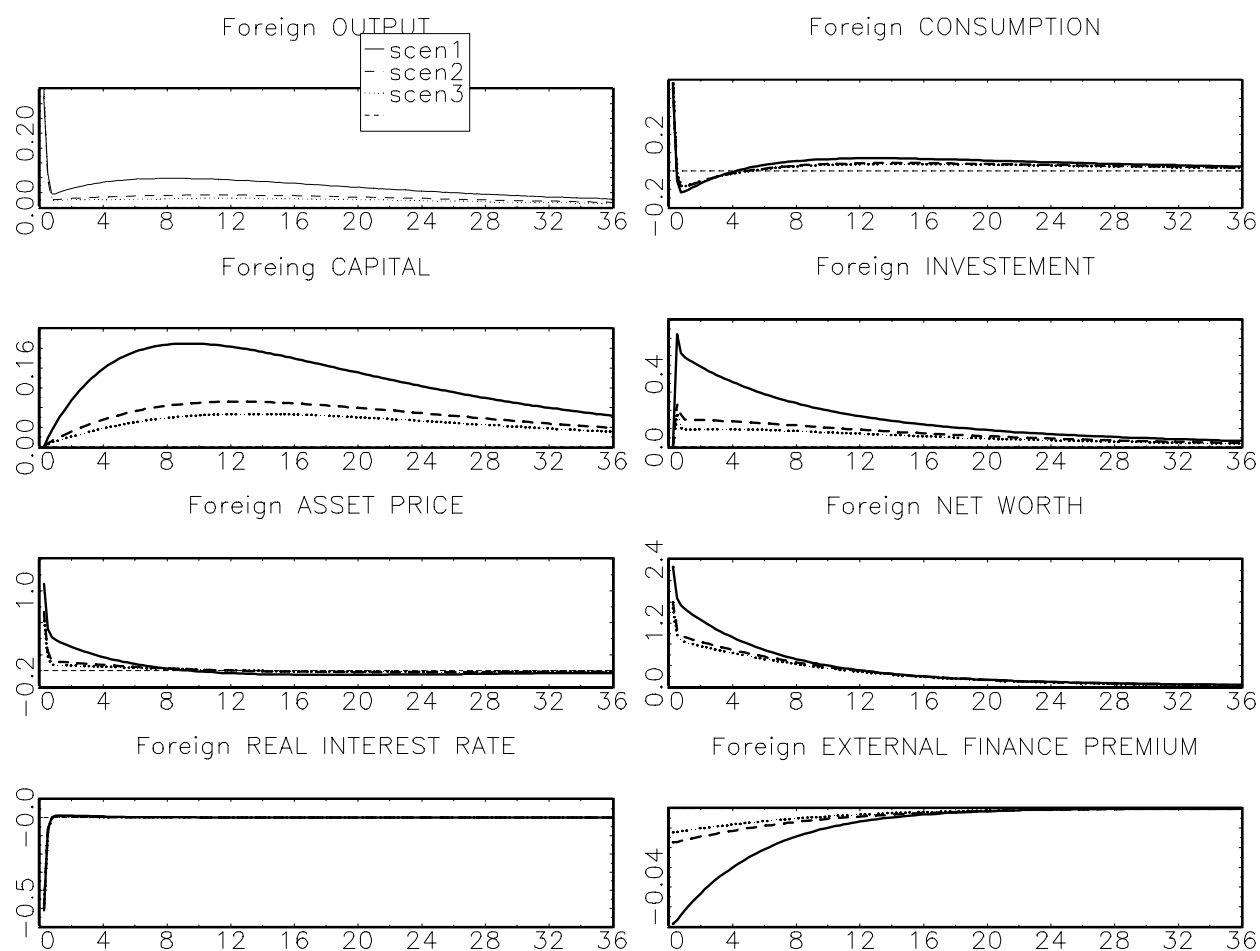


Figure 4: **Impulse responses of foreign variables. Symmetric and correlated monetary policy shocks under independent policies regime.**

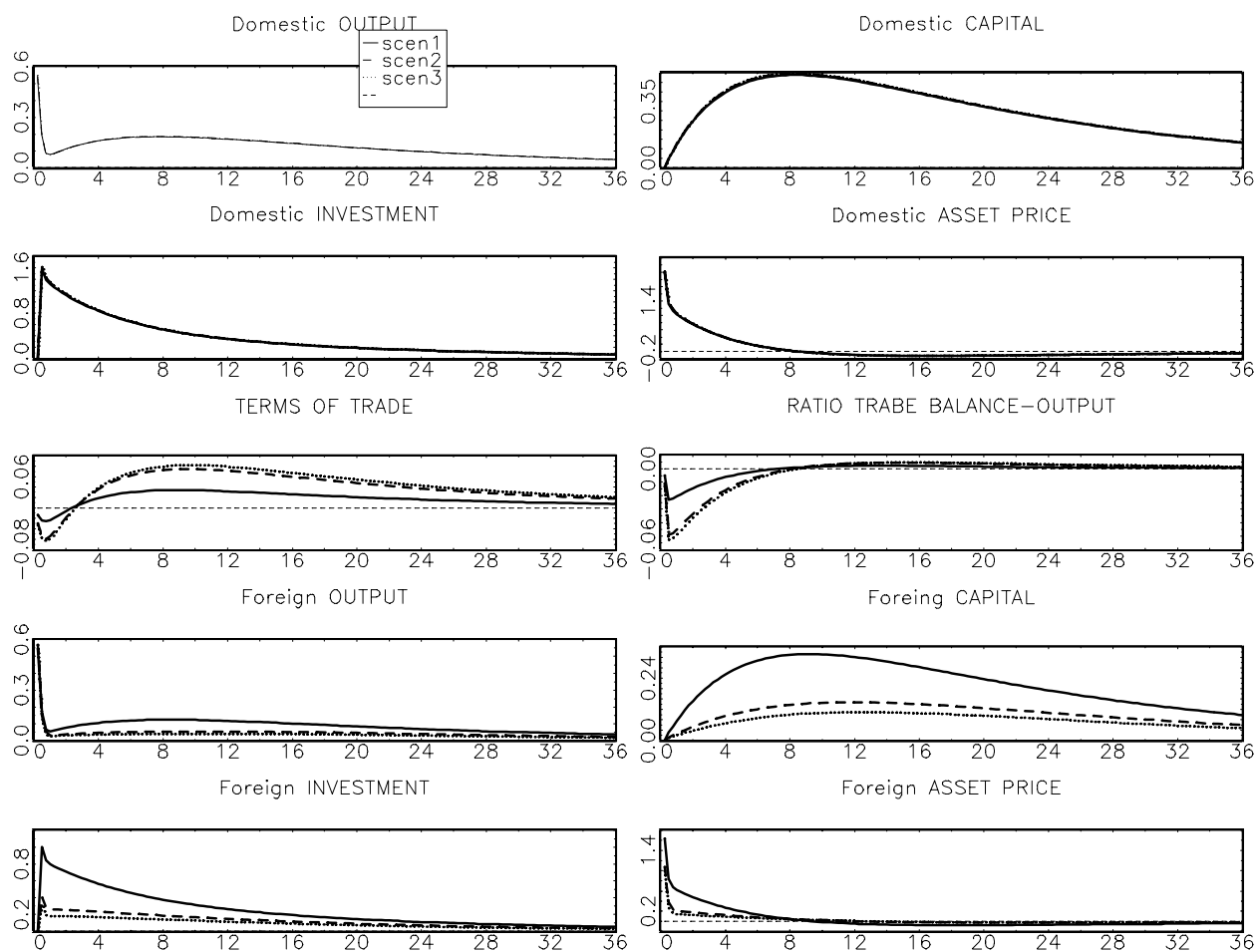


Figure 5: Impulse responses of domestic and foreign variables. Domestic monetary policy shock under unilateral peg.

Index of Working Papers:

August 28, 1990	Pauer Franz	1 ¹⁾	Hat Böhm-Bawerk Recht gehabt? Zum Zusammenhang zwischen Handelsbilanzpassivum und Budgetdefizit in den USA ²⁾
March 20, 1991	Backé Peter	2 ¹⁾	Ost- und Mitteleuropa auf dem Weg zur Marktwirtschaft - Anpassungskrise 1990
March 14, 1991	Pauer Franz	3 ¹⁾	Die Wirtschaft Österreichs im Vergleich zu den EG-Staaten - eine makroökonomische Analyse für die 80er Jahre
May 28, 1991	Mauler Kurt	4 ¹⁾	The Soviet Banking Reform
July 16, 1991	Pauer Franz	5 ¹⁾	Die Auswirkungen der Finanzmarkt- und Kapitalverkehrsliberalisierung auf die Wirtschaftsentwicklung und Wirtschaftspolitik in Norwegen, Schweden, Finnland und Großbritannien - mögliche Konsequenzen für Österreich ³⁾
August 1, 1991	Backé Peter	6 ¹⁾	Zwei Jahre G-24-Prozess: Bestandsaufnahme und Perspektiven unter besonderer Berücksichtigung makroökonomischer Unterstützungsleistungen ⁴⁾
August 8, 1991	Holzmann Robert	7 ¹⁾	Die Finanzoperationen der öffentlichen Haushalte der Reformländer CSFR, Polen und Ungarn: Eine erste quantitative Analyse
January 27, 1992	Pauer Franz	8 ¹⁾	Erfüllung der Konvergenzkriterien durch die EG-Staaten und die EG-Mitgliedswerber Schweden und Österreich ⁵⁾
October 12, 1992	Hochreiter Eduard (Editor)	9 ¹⁾	Alternative Strategies For Overcoming the Current Output Decline of Economies in Transition
November 10, 1992	Hochreiter Eduard and Winckler Georg	10 ¹⁾	Signaling a Hard Currency Strategy: The Case of Austria

1) vergriffen (out of print)

2) In abgeänderter Form erschienen in Berichte und Studien Nr. 4/1990, S 74 ff

3) In abgeänderter Form erschienen in Berichte und Studien Nr. 4/1991, S 44 ff

4) In abgeänderter Form erschienen in Berichte und Studien Nr. 3/1991, S 39 ff

5) In abgeänderter Form erschienen in Berichte und Studien Nr. 1/1992, S 54 ff

March 12, 1993	Hochreiter Eduard (Editor)	11	The Impact of the Opening-up of the East on the Austrian Economy - A First Quantitative Assessment
June 8, 1993	Anulova Guzel	12	The Scope for Regional Autonomy in Russia
July 14, 1993	Mundell Robert	13	EMU and the International Monetary System: A Transatlantic Perspective
November 29, 1993	Hochreiter Eduard	14	Austria's Role as a Bridgehead Between East and West
March 8, 1994	Hochreiter Eduard (Editor)	15	Prospects for Growth in Eastern Europe
June 8, 1994	Mader Richard	16	A Survey of the Austrian Capital Market
September 1, 1994	Andersen Palle and Dittus Peter	17	Trade and Employment: Can We Afford Better Market Access for Eastern Europe?
November 21, 1994	Rautava Jouko	18 ¹⁾	Interdependence of Politics and Economic Development: Financial Stabilization in Russia
January 30, 1995	Hochreiter Eduard (Editor)	19	Austrian Exchange Rate Policy and European Monetary Integration - Selected Issues
October 3, 1995	Groeneveld Hans	20	Monetary Spill-over Effects in the ERM: The Case of Austria, a Former Shadow Member
December 6, 1995	Frydman Roman et al	21	Investing in Insider-dominated Firms: A Study of Voucher Privatization Funds in Russia
March 5, 1996	Wissels Rutger	22	Recovery in Eastern Europe: Pessimism Confounded ?
June 25, 1996	Pauer Franz	23	Will Asymmetric Shocks Pose a Serious Problem in EMU?
September 19, 1997	Koch Elmar B.	24	Exchange Rates and Monetary Policy in Central Europe - a Survey of Some Issues
April 15, 1998	Weber Axel A.	25	Sources of Currency Crises: An Empirical Analysis

May 28, 1998	Brandner Peter, Diebalek Leopold and Schuberth Helene	26	Structural Budget Deficits and Sustainability of Fiscal Positions in the European Union
June 15, 1998	Canzeroni Matthew, Cumby Robert, Diba Behzad and Eudey Gwen	27	Trends in European Productivity: Implications for Real Exchange Rates, Real Interest Rates and Inflation Differentials
June 20, 1998	MacDonald Ronald	28	What Do We Really Know About Real Exchange Rates?
June 30, 1998	Campa José and Wolf Holger	29	Goods Arbitrage and Real Exchange Rate Stationarity
July 3, 1998	Papell David H.	30	The Great Appreciation, the Great Depreciation, and the Purchasing Power Parity Hypothesis
July 20, 1998	Chinn Menzie David	31	The Usual Suspects? Productivity and Demand Shocks and Asia-Pacific Real Exchange Rates
July 30, 1998	Cecchetti Stephen G., Mark Nelson C., Sonora Robert	32	Price Level Convergence Among United States Cities: Lessons for the European Central Bank
September 30, 1998	Christine Gartner, Gert Wehinger	33	Core Inflation in Selected European Union Countries
November 5, 1998	José Viñals and Juan F. Jimeno	34	The Impact of EMU on European Unemployment
December 11, 1998	Helene Schuberth and Gert Wehinger	35	Room for Manoeuvre of Economic Policy in the EU Countries – Are there Costs of Joining EMU?
December 21, 1998	Dennis C. Mueller and Burkhard Raunig	36	Heterogeneities within Industries and Structure-Performance Models
May 21, 1999	Alois Geyer and Richard Mader	37	Estimation of the Term Structure of Interest Rates – A Parametric Approach
July 29, 1999	José Viñals and Javier Vallés	38	On the Real Effects of Monetary Policy: A Central Banker's View
December 20, 1999	John R. Freeman, Jude C. Hays and Helmut Stix	39	Democracy and Markets: The Case of Exchange Rates

March 01, 2000	Eduard Hochreiter and Tadeusz Kowalski	40	Central Banks in European Emerging Market Economies in the 1990s
March 20, 2000	Katrin Wesche	41	Is there a Credit Channel in Austria? The Impact of Monetary Policy on Firms' Investment Decisions
June 20, 2000	Jarko Fidrmuc and Jan Fidrmuc	42	Integration, Disintegration and Trade in Europe: Evolution of Trade Relations During the 1990s
March 06, 2001	Marc Flandreau	43	The Bank, the States, and the Market, A Austro-Hungarian Tale for Euroland, 1867-1914
May 01, 2001	Otmar Issing	44	The Euro Area and the Single Monetary Policy
May 18, 2001	Sylvia Kaufmann	45	Is there an asymmetric effect of monetary policy over time? A Bayesian analysis using Austrian data.
May 31, 2001	Paul De Grauwe and Marianna Grimaldi	46	Exchange Rates, Prices and Money. A Long Run Perspective
June 25, 2001	Vítor Gaspar, Gabriel Perez-Quiros and Jorge Sicilia	47	The ECB Monetary Strategy and the Money Market
July 27, 2001	David T. Llewellyn	48	<i>A Regulatory Regime</i> For Financial Stability
August 24, 2001	Helmut Elsinger and Martin Summer	49	Arbitrage Arbitrage and Optimal Portfolio Choice with Financial Constraints
September 1, 2001	Michael D. Goldberg and Roman Frydman	50	Macroeconomic Fundamentals and the DM/\$ Exchange Rate: Temporal Instability and the Monetary Model
September 8, 2001	Vittorio Corbo, Oscar Landerretche and Klaus Schmidt-Hebbel	51	Assessing Inflation Targeting after a Decade of World Experience
September 25, 2001	Kenneth N. Kuttner and Adam S. Posen	52	Beyond Bipolar: A Three-Dimensional Assessment of Monetary Frameworks

October 1, 2001	Luca Dedola and Sylvain Leduc	53	Why Is the Business-Cycle Behavior of Fundamentals Alike Across Exchange-Rate Regimes?
October 10, 2001	Tommaso Monacelli	54	New International Monetary Arrangements and the Exchange Rate
December 3, 2001	Peter Brandner, Harald Grech and Helmut Stix	55	The Effectiveness of Central Bank Intervention in the EMS: The Post 1993 Experience
January 2, 2002	Sylvia Kaufmann	56	Asymmetries in Bank Lending Behaviour. Austria During the 1990s
January 7, 2002	Martin Summer	57	Banking Regulation and Systemic Risk
January 28, 2002	Maria Valderrama	58	Credit Channel and Investment Behavior in Austria: A Micro-Econometric Approach
February 18, 2002	Gabriela de Raaij and Burkhard Raunig	59	Evaluating Density Forecasts with an Application to Stock Market Returns
February 25, 2002	Ben R. Craig and Joachim G. Keller	60	The Empirical Performance of Option Based Densities of Foreign Exchange
February 28, 2002	Peter Backé, Jarko Fidrmuc, Thomas Reininger and Franz Schardax	61	Price Dynamics in Central and Eastern European EU Accession Countries
April 8, 2002	Jesús Crespo- Cuaresma, Maria Antoinette Dimitz and Doris Ritzberger- Grünwald	62	Growth, Convergence and EU Membership
May 29, 2002	Markus Knell	63	Wage Formation in Open Economies and the Role of Monetary and Wage-Setting Institutions
June 19, 2002	Sylvester C.W. Eijffinger (comments by: José Luis Malo de Molina and by Franz Seitz)	64	The Federal Design of a Central Bank in a Monetary Union: The Case of the European System of Central Banks

July 1, 2002	Sebastian Edwards and I. Igal Magendzo (comments by Luis Adalberto Aquino Cardona and by Hans Genberg)	65	Dollarization and Economic Performance: What Do We Really Know?
July 10, 2002	David Begg (comment by Peter Bofinger)	66	Growth, Integration, and Macroeconomic Policy Design: Some Lessons for Latin America
July 15, 2002	Andrew Berg, Eduardo Borensztein, and Paolo Mauro (comment by Sven Arndt)	67	An Evaluation of Monetary Regime Options for Latin America
July 22, 2002	Eduard Hochreiter, Klaus Schmidt-Hebbel and Georg Winckler (comments by Lars Jonung and George Tavlas)	68	Monetary Union: European Lessons, Latin American Prospects
July 29, 2002	Michael J. Artis (comment by David Archer)	69	Reflections on the Optimal Currency Area (OCA) criteria in the light of EMU
August 5, 2002	Jürgen von Hagen, Susanne Mundschenk (comments by Thorsten Polleit, Gernot Doppelhofer and Roland Vaubel)	70	Fiscal and Monetary Policy Coordination in EMU
August 12, 2002	Dimitri Boreiko (comment by Ryszard Kokoszcyński)	71	EMU and Accession Countries: Fuzzy Cluster Analysis of Membership
August 19, 2002	Ansgar Belke and Daniel Gros (comments by Luís de Campos e Cunha, Nuno Alves and Eduardo Levy-Yeyati)	72	Monetary Integration in the Southern Cone: Mercosur Is Not Like the EU?
August 26, 2002	Friedrich Fritzer, Gabriel Moser and Johann Scharler	73	Forecasting Austrian HICP and its Components using VAR and ARIMA Models

September 30, 2002	Sebastian Edwards	74	The Great Exchange Rate Debate after Argentina
October 3, 2002	George Kopits (comments by Zsolt Darvas and Gerhard Illing)	75	Central European EU Accession and Latin American Integration: Mutual Lessons in Macroeconomic Policy Design
October 10, 2002	Eduard Hochreiter, Anton Korinek and Pierre L. Siklos (comments by Jeannine Bailliu and Thorvaldur Gylfason)	76	The Potential Consequences of Alternative Exchange Rate Regimes: A Study of Three Candidate Regions
October 14, 2002	Peter Brandner, Harald Grech	77	Why Did Central Banks Intervene in the EMS? The Post 1993 Experience
October 21, 2002	Alfred Stiglbauer, Florian Stahl, Rudolf Winter-Ebmer, Josef Zweimüller	78	Job Creation and Job Destruction in a Regulated Labor Market: The Case of Austria
October 28, 2002	Elsinger, Alfred Lehar and Martin Summer	79	Risk Assessment for Banking Systems
November 4, 2002	Helmut Stix	80	Does Central Bank Intervention Influence the Probability of a Speculative Attack? Evidence from the EMS
June 30, 2003	Markus Knell, Helmut Stix	81	How Robust are Money Demand Estimations? A Meta-Analytic Approach
July 7, 2003	Helmut Stix	82	How Do Debit Cards Affect Cash Demand? Survey Data Evidence
July 14, 2003	Sylvia Kaufmann	83	The business cycle of European countries. Bayesian clustering of country-individual IP growth series.
July 21, 2003	Jesus Crespo Cuaresma, Ernest Gnan, Doris Ritzberger-Gruenwald	84	Searching for the Natural Rate of Interest: a Euro-Area Perspective
July 28, 2003	Sylvia Frühwirth-Schnatter, Sylvia Kaufmann	85	Investigating asymmetries in the bank lending channel. An analysis using Austrian banks' balance sheet data

September 22, 2003	Burkhard Raunig	86	Testing for Longer Horizon Predictability of Return Volatility with an Application to the German DAX
May 3, 2004	Juergen Eichberger, Martin Summer	87	Bank Capital, Liquidity and Systemic Risk
June 7, 2004	Markus Knell, Helmut Stix	88	Three Decades of Money Demand Studies. Some Differences and Remarkable Similarities
August 27, 2004	Martin Schneider, Martin Spitzer	89	Forecasting Austrian GDP using the generalized dynamic factor model
September 20, 2004	Sylvia Kaufmann, Maria Teresa Valderrama	90	Modeling Credit Aggregates
Oktober 4, 2004	Gabriel Moser, Fabio Rumler, Johann Scharler	91	Forecasting Austrian Inflation
November 3, 2004	Michael D. Bordo, Josef Christl, Harold James, Christian Just	92	Exchange Rate Regimes Past, Present and Future
December 29, 2004	Johann Scharler	93	Understanding the Stock Market's Response to Monetary Policy Shocks
Decembert 31, 2004	Harald Grech	94	What Do German Short-Term Interest Rates Tell Us About Future Inflation?
February 7, 2005	Markus Knell	95	On the Design of Sustainable and Fair PAYG - Pension Systems When Cohort Sizes Change.
March 4, 2005	Stefania P. S. Rossi, Markus Schwaiger, Gerhard Winkler	96	Managerial Behavior and Cost/Profit Efficiency in the Banking Sectors of Central and Eastern European Countries
May 12, 2005	Ester Faia	97	Financial Differences and Business Cycle Co-Movements in A Currency Area