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Financial Market Integration in a Monetary Union

by

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Abstract:

Financial markets in Euroland differ from those of a national monetary union in two regards. First, capital markets in general and banking markets in particular show a greater degree of segmentation than national financial markets as a result of information costs and regulatory barriers to full integration. Second, financial market structures differ among the members of Euroland, which potentially affects the transmission of (monetary) shocks. This paper provides a simple model of a currency union which takes these peculiarities into account, focusing on the interaction of financial structures, the degree of capital mobility, the transmission of shocks, and the portfolio choices of banks.

Keywords: monetary union, capital mobility, financial structures, transmission channels, commercial banking

JEL-classification: F36 (Financial Aspects of Economic Integration)

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List of Variables

a	income elasticity of deposit supply
b	interest elasticity of deposit supply
e	income elasticity of loan demand
t	interest elasticity of loan demand
q	monitoring resources of banks
f	degree of risk aversion of banks
g	interest elasticity of aggregate demand
m	deposit demand shock
r	correlation coefficient
s	standard deviation
w	loan demand shock
P	profits of banks
A	assets of commercial banks
$B^D\left(B^S\right)$	demand for (supply of) bonds
c	variable costs of cross-border banking
$D^D\left(D^S\right)$	demand for (supply of) bank deposits
I	domestic investment
$L^D\left(L^S\right)$	demand for (supply of) bank loans
m	efficiency parameter of bank monitoring
NFA	net foreign assets
NX	net exports
$r^D\left(r^L\right)$	deposit (lending) rate
r	bond rate
$y^D\left(y^S\right)$	demand for (supply of) output
U	objective function of banks
z	demand shock

1 Motivation

As compared to a national monetary union, capital markets in Euroland are not only more heterogenous with regard to their institutional structures, but they are also characterized by a lower degree of interregional capital mobility. This limited scope of financial integration, in turn, has a potential bearing on (monetary) transmission mechanisms. To see this, consider two countries that share a common currency but have completely isolated financial systems, i.e. there are no capital flows between them. In this case, a common monetary policy will have different real sector effects in the two economies, depending on the relative speed and structure of monetary transmission. If these two economies were completely integrated financially in the sense that different financial market structures would persist but that arbitrage would ensure equalization of returns in each market segment, adjustment processes would be more homogenous. There would be a tendency for differences in transmission mechanisms to level out over time. Hence, while the degree of interregional capital mobility under identical financial market structures would have no impact on the transmission process, the reverse does not hold true: if financial markets differ, the spill over effects of shocks will depend upon the mobility of capital between regions.

The academic debate to date has focused mainly on the implications of differences in financial market structures on the transmission of (monetary) shocks across countries (Carlino and DeFina 1998, Cecchetti 1999, Clausen and Wohltmann 2000, De Bondt 2000, Dornbusch et al. 1998, Kakes 2000) but has largely abstracted from the implications of different degrees of capital mobility for transmission mechanisms or the transmission of other shocks. However, while there is an in-

creasing amount of evidence that financial markets in Europe have become increasingly integrated over time (Fratzscher 2001, Lemmen 1998), some important market segments such as retail banking markets remain largely national in scope (Berger et al. 2000). At the same time, recent empirical evidence suggests that shocks might be propagated through the international activities of commercial banks (Peek and Rosengren 1997 and 2000, Van Rijckeghem and Weder 2000).

The purpose of this paper is to provide a simple framework which allows us to analyze both the implications of differences in transmission mechanisms and of incomplete integration of financial markets, in particular banking markets, for the transmission of shocks. We consider not only monetary but also fiscal or other demand shocks. Part 2 motivates the analysis by providing some stylized facts on the degree of integration of financial markets and differences in financial structures across Europe. Part 3 introduces a simple open economy model which builds on the closed-economy version of Bernanke and Blinder (1988). In contrast to earlier work, we explicitly model the intermediary role of commercial banks for international capital flows, and we distinguish between differences in financial structures across countries and different degrees of capital mobility. Part 4 solves the model and performs the comparative static analysis for domestic demand shocks, changes in the degree of capital mobility, changes in financial structures, and monetary policy shocks. Part 5 extends the baseline model by shedding more light on the links between distance, the monitoring costs of banks, and their international portfolio choices. Part 6 discusses the implications of this model in relation to models that have been proposed in the literature to study the macroeconomic implications of financial integration and increased competition in banking. Part 7 concludes and summarizes the main results.

The papers closest in spirit to the present one are Driscoll (2000), Giovannetti and Marimon (2000), and McPherson and Waller (2000). Driscoll (2000) extends the model by Bernanke and

Blinder (1988) to the setting of a currency union, assuming that bond markets are integrated fully while banking markets are not. In an empirical analysis for the United States, he finds that regional shocks to money demand have implications for the regional supply of bank loans, suggesting that financial markets are segmented. McPherson and Waller (2000) analyze the transmission of shocks under conditions of incomplete mobility of capital in a currency union, arguing that the correlation between regional bank lending and regional income can be taken as a proxy for the degree of segmentation of financial markets. However, these papers do not model regional differences in transmission mechanisms and/or the portfolio choices of banks. Giovannetti and Marimon (2000) analyze the implications of differences in financial structures and of incomplete integration of regional banking markets on the effects of monetary policy in a monetary union. In contrast to the present paper, their focus is on the effects of differences in the efficiency of commercial banks across regions.

Two recent papers have also taken up the issue of financial contagion which arises even in the absence of exchange rate changes.[1] Allen and Gale (2000) use a Diamond-Dybvig-type bank run model to analyze the impact of varying degrees of financial integration on the transmission of liquidity shocks. One key insight of their model is that there is a non-linear relationship between the degree of financial integration and the transmission of shocks across countries since, as the degree of integration increases, bilateral financial linkages are loosing in importance. In a related paper, Freixas et al. (2000) focus on the spill-over of solvency shocks through interbank markets. Inter-

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[1] Another strand of the literature has dealt with the role of the banking sector in propagating financial crises (Aghion et al. 2000, Buch and Heinrich 1999, Cespedes et al. 2000, Lahiri and Vegh 2000). The main mechanism through which financial crises are transmitted in these papers is the exchange rate channel: (unexpected) devaluations of the domestic currency lead to a decline in the net worth of commercial banks to the extent that their liabilities (either directly or indirectly) show a currency mis-match. Obviously, since the exchange rate channel does not exist in a common currency area, we need not consider this effect.

bank linkages are shown to have a positive effect as they increase the resilience of a banking system to cushion solvency shocks. The costs of increased interbank linkages is, at the same time, that insolvent banks might stay in business because they can draw on interbank credit lines. Hence, a potential role for the central bank to close insolvent banks emerges. Both of these papers, however, do not analyze the impact of differences in financial structures for the transmission of shocks.

2 Stylized Facts

There is a strong conventional wisdom that the degree of capital mobility in Euroland differs from that of a monetary union formed by a single nation and that the structure of national financial markets is more heterogenous.[2] However, how large these differences are and to what extent they eventually impinge upon the transmission of shocks across countries is still pretty much open to debate. Two factors are responsible for this. While it is, first, relatively easy to compute different measures of capital mobility for individual members of Euroland vis-à-vis the rest of the world, it becomes inherently more difficult to obtain evidence on the degree of capital mobility *among* these countries or *among*, for instance, the US states. Second, a number of studies has dealt with differences in the structure of financial markets in general and the financial structure of firms, in particular across Europe.[3] Yet, comparable information for regions of a national monetary union such as the United States is, to the best of our knowledge, not available.

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2 See, e.g., Dornbusch et al. (1998).

3 See, for instance, Schmidt et al. (1999).

Without laying the claim for being complete, this section brings together stylized facts which show the disparities that exist both between the members of Euroland and between Europe and the US with regard to capital mobility and financial structures.

2.1 Capital Mobility

Considering the degree of capital mobility first, there is a considerable amount of evidence suggesting an increasing degree of integration of Europe into international capital markets on an aggregated level (Fratzscher 2001, Lemmen 1998). However, the degree of *intra*-regional capital mobility can be gauged only indirectly, mainly because of a lack of data on interregional capital flows. Using the degree of capital mobility within existing currency unions such as the US as a benchmark, there are reasons to believe that institutional differences across Europe are larger, thus impeding the full integration of markets (Buch 2001).

In addition, there is relatively clear evidence for a greater dispersion of national interest rates in Europe in comparison to regional interest rates in the US (Graphs 1 and 2). And, although interest rates in Europe have converged over time (Kleimeier and Sander 2000), particularly in money markets,[4] retail interest rates show a substantially greater degree of heterogeneity (Centeno and Mello 1999). Generally, the degree of integration of retail banking markets is likely to be substantially below that of wholesale markets. Due to asymmetries in information between countries, even

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4 See also BIS (2001) which argues that interbank and the corporate bond market in Europe show a relatively large degree of integration already while the collaterized money market and equity markets are still national in scope.

interbank markets may not be integrated fully (Freixas and Holthausen 2000).[5] Finally, there is evidence that the degree of inter-regional risk sharing — as an indicator for the integration of financial markets — is less pronounced in Europe than in the US (Atkeson and Bayoumi 1993, Hess and Shin 2000).

When analyzing the causes for the greater segmentation of financial markets, it is useful to distinguish between economic and regulatory barriers to full integration. In contrast to a national monetary union such as the United States, the regulatory structure of financial markets across Euroland still differ despite the on-going efforts aimed at harmonizing regulations. Hence, although direct regulatory restrictions to the integration of financial markets such as capital controls have been abolished, a substantial amount of indirect regulatory barriers still exist. These raise the costs of international financial transactions over and above the costs of domestic financial transactions.

In addition, the segmentation of financial markets in Europe is not only due to regulatory but also to cultural barriers.[6] In comparison to the US states there is a substantially larger disparity of languages and business practices across Europe. These cultural barriers both raise the costs of obtaining information about foreign markets and tend to proliferate even if direct regulatory barriers have been abolished fully. In the theoretical model below, we will isolate these two effects by distinguishing between information costs, which are due to cultural and institutional differences, and transactions costs, which arise from the presence of different regulatory environments.

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5 In other words, by analyzing the degree of integration of markets for securitized financial assets such as stock markets alone, it is difficult to draw conclusions concerning the degree of integration of markets for non-securitized assets such as bank loans and deposits.

6 See, e.g. Berger et al. (2000).

2.2 Financial Structures

Differences in regulations across countries not only affect the degree of capital mobility but also the structure of financial markets and the sources of finance for firms. Through this channel, they also affect the transmission of monetary impulses. Bernanke and Blinder (1988) have been among the first to argue that the transmission mechanism of monetary policy depends on financial structures, leading to a credit channel of monetary policy.

For Europe, this would imply that differences in transmission mechanisms across countries lead to different regional effects of a common monetary policy (Carlino and DeFina 1998, Cecchetti 1999, Clausen and Wohltmann 2000, De Bondt 2000, Dornbusch et al. 1998). Since these arguments are based on historical data, the Lucas critique applies. Arnold and de Vries (2000) have thus challenged the conventional wisdom by arguing that financial structures are likely to be endogenous and that the European Central Bank (ECB) should face relatively homogenous conditions in the near future.[7] Yet, they consider money and capital markets only rather than the relative importance of bank- versus market-based finance. To the extent that institutional structures have a bearing on financial structures and that these change only slowly (Cecchetti 1999), differences are thus likely to remain.[8] Recent empirical evidence is in support of this. Ciccarelli and Rebucci (2001) and De Haan et al. (2001) find that transmission channels differ across European countries, and that these differences do not seem to have become smaller over time.

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7 For a similar conclusion see Peersman (2000).

8 Complementarities in corporate governance systems may be responsible for this (Heinrich 2001).

Hence, it would be of interest to compare the degree of regional disparities of financial structures in the US to that of Europe. Unfortunately, such data on a regional basis are not available for the US. The fact that regional institutional conditions are more heterogeneous in Europe than in the US, however, would imply that financial structures also show a greater degree of diversity (Cecchetti 1999). Within the European Monetary Union, for instance, the share of bank loans in the external financial sources of firms ranges between 39 percent for Finland and 80 percent in Ireland (Peersman 2000). Countries thus differ with regard to the ease with which firms can switch between different forms of finance. Also, disintermediation trends differ across countries. Comparing developments in France, Germany, and the United Kingdom, Schmidt et al. (1999), for instance, find evidence for a decline in the role of banks for France only.

Although theory predicts that these differences in the structure of financial systems should have a bearing on the link between monetary policy and the real sector, the empirical evidence on the presence of the credit channel in Europe is, as for other countries, mixed.[9] While, for instance, de Bondt (1999) finds evidence in favor of the bank lending channel, results of Favero et al. (1999) do not support this view.

3 The Baseline Model

In this section, we present a simple open-economy model of a currency union which brings together the above stylized facts. Our approach is similar to those that have been used for analyzing trans-

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9 See also Giovannetti and Marimon (2000).

mission mechanisms in open economies.[10] In contrast to earlier work, however, we explicitly take account of the fact that national financial markets remain segmented, i.e. that capital mobility is incomplete, and that a relatively large share of international capital flows is typically channeled through intermediaries such as banks. The focus on banks is motivated by the observation that, despite the on-going disintermediation trend, banks continue to be major providers of international financial services. For Germany, for instance, about 30 percent of capital exports and almost 40 percent of its imports between 1992 and 2000 were channeled through banks (Deutsche Bundesbank 2000). In addition, we allow for differences in the financial structures between countries which eventually lead to differences in the transmission mechanisms of monetary policy. The standard model is thus extended in two main directions:

First, following Bernanke and Blinder (1988), we distinguish between bank loans and bonds as sources of finance for firms. Bonds, in turn, are held by households and banks. This affects the transmission channel of monetary impulses as the financing of some firms will depend on receiving bank loans. An expansionary monetary policy, through lowering the bond rate, increases the amount of funds available to banks, which transmits into an increase of credit and output (Mishkin 1996).[11] Departing from earlier work, we are more explicit about the intermediary role of commercial banks. The positive output response arises from the fact that lower bond rates reduce the return on alternative investment opportunities for banks, thus inducing them to increase lending.[12] We as-

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[10] In Section 6, we will discuss possible extensions which take the insights of international macro-models of more recent vintage into account.

[11] In the terminology of the Mundell-Flemming model, this effect arises because a monetary expansion not only shifts the LM- but also the IS-schedule.

[12] Freixas and Rochet (1998) likewise discuss a variant of the model by Bernanke and Blinder (1988) which takes the optimization problem of commercial banks, albeit in a closed economy, into account. For an integration of banks into an open-economy macro model see also Rødseth (2000).

sume incomplete inter-regional mobility of capital by introducing costs of cross-border lending (and borrowing) and by noting that banks hold a portfolio of domestic and foreign assets and liabilities. Bond markets, to the contrary, are assumed to be fully integrated interregionally.[13] The main point that will be stressed in the following is that cross-border financial transactions, due to the presence of information costs and/or regulations,[14] are more costly than domestic transactions.

Second, we assume that, because of differences of institutional structures and financial sector regulations, the ease with which firms can substitute bank loans and bond finance differs between countries. This will be captured through differences in the interest elasticity of loan demand between countries.

In the following, we present the baseline model of capital flows in a currency union formed by two countries (i = 1,2), and we abstract from the fact that the currency union has a flexible exchange rate regime with respect to the rest of the world. Hence, we ignore exchange rate effects. Each country hosts an exogenously given number of banks. For convenience, we are studying the behavior of one representative bank in each country only.

3.1 Market Structures

We consider three different financial market segments: the market for bank loans, the market for bank deposits, and the bond market. This gives the following equilibrium conditions for the domestic economy:

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13 This assumption is backed by the empirical observations that bond markets in Euroland have integrated and expanded rapidly after the introduction of the euro (Danthine et al. 2000).

14 For empirical evidence supporting this view see Buch (2000) or Portes and Rey (1999).

(1a) $L_i^D = L_i^S = L_{i,i}^S + L_{j,i}^S$ loan market

(1b) $D_i^S = D_i^D = D_{i,i}^D + D_{j,i}^D$ deposit market

(1c) $y_i^S = y_i^D = I_i + NX_i + z_i$ output market

(1d) $B_i^D + B_j^D = B_i^S + B_j^S$ bond market

(1e) $r_i = r_j = r$ interest parity

All variables are expressed in real terms and in logarithms (with the exception of interest rates) such that the coefficients can be interpreted as elasticities. L_i^D is the demand for loans on the home market, which must be equal to the supply of loans by domestic ($L_{i,i}^S$) and foreign banks ($L_{j,i}^S$).[15] Similarly, the supply of deposits on the domestic market D_i^S equals the demand for deposits by domestic ($D_{i,i}^D$) and foreign banks ($D_{j,i}^D$). Real domestic output supply (y_i^S) must equal aggregate domestic demand (y_i^D) as the sum of domestic investment (I_i), net exports (NX_i), and a stochastic output shock (z_i) due to shifts in private sector consumption or government expenditure. In contrast to deposit and loan markets, the bond market is fully integrated. Hence, the supply of bonds both by domestic and foreign firms ($B_i^S + B_j^S$) must equal the demand for bonds at home and abroad ($B_i^D + B_j^D$), and interest parity holds in this market segment (1e). Symmetric equilibrium conditions apply to the foreign country. Notice that, due to our assumption that markets for

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15 The first subscript denotes the country of origin of the bank while the second stands for the market in which this bank operates.

bank deposits and loans are regional in scope, regional deposit and lending rates are allowed to differ.

3.2 Households

Households have a fixed amount of financial wealth which they can use for current consumption and savings. Since the focus of this paper is on the financial structure of firms, we keep the household-side as simple as possible, and we assume that the savings decision is unaffected by interest rates. In other words, we assume that the income and the substitution effect of a change in interest rates just cancel out, which would be in line with empirical studies finding a weak impact of interest rates on savings at best (Loayza et al. 2000).

Savings are allocated between bond holdings and bank deposits held with domestic or foreign banks on the domestic market: $S_i = B_i^{D,H} + D_{i,i}^S + D_{j,i}^S = B_i^{D,H} + D_i^S$.[16] Households (just as firms) are assumed to be numerous and thus to take interest rates as exogenous. The supply of domestic deposits can therefore be written as a positive function of the difference between the deposit and the bond rate, and of income:

$$D_i^S = a_i y_i + b_i \left(r_i^D - r\right) + m_i \qquad (2)$$

where $a_i (b_i)$ = income (interest) elasticity of supply of deposits, m_i = money demand shock in region *I*, with s_m = standard deviation of money demand shocks, and $r_m = r\left(m_i, m_j\right)$ = correlation of regional money demand shocks. Throughout the paper, all parameters are assumed to be posi-

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16 The results would be essentially the same if we assumed that households also hold a certain fraction of their deposits in the form of cash.

tive. A symmetric expression can be derived for the demand for deposits in the foreign country. Although, in a general equilibrium framework, households would own firms and banks, we assume that they are small and thus ignore the impact of their decisions on the profits of banks and firms in their optimization. Notice that, although we are keeping domestic savings constant, the allocation of savings across deposits and bonds is endogenous and will affect the magnitude of international capital flows.

3.3 Firms

Domestic firms do not have equity and have to borrow to finance their investment plans (I_i). They can obtain financing from three sources. They can either issue bonds on the union-wide bond market or their can borrow from domestic or foreign banks operating on the domestic retail banking market:[17] $I_i = B_i^S + L_{i,i}^D + L_{j,i}^D$. The demand for loans on the domestic market is a positive function of domestic income and a negative function of the difference between the lending and the bond rate:

$$L_i^D = e_i y_i - t_i\left(r_i^L - r\right) + w_i \qquad (3)$$

where w_i = domestic loan demand shock and t_i (e_i) = interest (income) elasticity of loan demand.

Bonds and loans are imperfect substitutes $(0 < t_i < 1)$. The ease with which firms can switch from loans to bonds depends, for example, on the degree of asymmetries in information which, in

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17 We have set up the model such that foreign banks incur a variable cost when entering the domestic market. Similarly, we could assume that domestic firms have to pay an additional costs when borrowing directly on the foreign market. Changing this assumption would leave the qualitative results of the analysis unchanged.

turn, is a function of underlying industry characteristics or the share of smaller firms which tend to be more opaque. Also, institutional conditions such as the scope of reporting requirements and the institutional structure of the financial systems are factors that influence financing choices. In the two country (or region) setting that we are considering here, information costs and institutions are likely to differ, thus leading to differences in financial structures. We capture this by allowing the interest elasticity of loan demand with respect to the interest rate differential to differ between regions ($t_i \neq t_j$).

3.4 Banks

Banks are playing an active role in linking domestic and foreign financial markets. In fact, they are assumed to be the only agents which arbitrage between markets, which is, ceteris paribus, equivalent to assuming that households and firms face higher costs of cross-border transactions than banks. Domestic banks demand deposits at home ($D^D_{i,i}$) and abroad ($D^D_{i,j}$) and supply loans on the domestic ($L^S_{i,i}$) and on the foreign market ($L^S_{i,j}$). In addition, banks can hold bonds ($B^{D,B}_i$). The same options are available for foreign banks.

The balance sheet of a representative domestic bank is given by:

$$A_i \equiv D^D_{i,i} + D^D_{i,j} = L^S_{i,i} + L^S_{i,j} + B^{D,B}_i \tag{4}$$

where A_i = total assets. In order to simplify the analysis, we assume that banks do not hold equity, which does not affect our analysis if we rule out the possibility that banks can go bankrupt. Profits can be written as:

$$\Pi_i = r^L_i L^S_{i,i} + \left(r^L_j - c_i\right)L^S_{i,j} + rB^D_i - r^D_i D^D_{i,i} - \left(r^D_j + c_i\right)D^D_{i,j} \tag{5}$$

with c_i = variable costs of making loans and raising deposits outside the home region. We start by lumping together transaction costs which are due to regulatory restrictions and information costs. This route has been taken in a number of recent papers analyzing the international allocation of assets.[18] Also, although these costs are likely to differ for raising deposits and granting loans abroad, we assume them to be identical for ease of exposition.

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[18] See, for instance, Martin and Rey (2001).

We assume that banks not only care about their expected profits but also about the risk of their portfolios ($s^2(P_i)$).[19] The objective function is thus increasing in expected profits and decreasing in portfolio variance:

$$U_i = E(\Pi_i) - \frac{1}{2} f_i s^2(\Pi_i) \tag{6}$$

where $f > 0$ denotes the bank's degree of risk aversion. This risk aversion of banks could be endogenized by assuming that banks face a positive probability of insolvency, and that insolvencies are costly.[20] Portfolio risk is given by:[21]

$$s^2(P_i) = \sum_{m=1}^{4} x_{i,m}^2 s_m^2 + 2 \sum_{m=1}^{4} \sum_{\substack{n=1 \\ m \neq n}}^{4} x_{i,m} x_{i,n} COV_{mn}\,, \qquad x = \begin{pmatrix} x_{i,1} \\ x_{i,2} \\ x_{i,3} \\ x_{i,4} \end{pmatrix} = \begin{pmatrix} L_{i,i}^S \\ -D_{i,i}^D \\ L_{i,j}^S \\ -D_{i,j}^D \end{pmatrix}, \tag{7}$$

where x_i denote portfolio shares, which are negative for the liabilities of the bank. The covariance matrix is $COV = \begin{pmatrix} s_{i,z}^2 & r_{zm} s_{i,z} s_{i,m} & r_{zz} s_{i,z} s_{j,z} & r_{zm} s_{i,z} s_{j,m} \\ r_{zm} s_{i,z} s_{i,m} & s_{i,m}^2 & r_{zm} s_{j,z} s_{i,m} & r_{mm} s_{i,m} s_{j,m} \\ r_{zz} s_{i,z} s_{j,z} & r_{mm} s_{i,m} s_{j,m} & s_{j,z}^2 & r_{zm} s_{j,z} s_{j,m} \\ r_{zm} s_{i,z} s_{j,m} & r_{zm} s_{j,z} s_{i,m} & r_{zm} s_{j,z} s_{j,m} & s_{j,m}^2 \end{pmatrix}$, $s_{i,z}$ ($s_{i,m}$) is the standard deviation of domestic loan returns (costs of deposits), and r are the correlations between shocks.

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19 Freixas and Rochet (1998) present a simple model of bank behavior in a mean-variance framework.

20 Baltensperger and Milde (1987) provide a more detailed analysis of banks' insolvency and liquidity costs.

21 Note that we assume that the rate of return on bonds is risk-free.

3.5 Net Foreign Assets

International capital flows can be derived from the changes in the international assets and liabilities of commercial banks plus the difference between the domestic demand for and supply of bonds. A capital inflow into the domestic economy is given by an increase in banks' foreign liabilities, i.e. the amount of loans granted by foreign banks in the domestic economy plus the amount of deposits raised by domestic banks abroad. Capital outflows are given by an increase in loans granted by domestic banks abroad plus the amount of deposits raised by foreign banks on the domestic market. Also, if domestic demand for bonds exceeds domestic supply, this leads to a capital outflow.

If we assume that assets and liabilities are zero initially, net capital flows out of the domestic economy are identical to the net assets of domestic commercial banks at the end of the period plus net foreign bond holdings:

$$(8) \qquad NFA_i = L_{i,j} + D_{j,i} - L_{j,i} - D_{i,j} + B_i^{D,H} + B_i^{D,B} - B_i^S$$

3.6 Aggregate Demand

In order to focus on the effects of the transmission channels through banks' balance sheets, we are using a highly simplified specification of aggregate demand and capture the consumption demand of the private sector and the role of the government only through a stochastic demand shock. Hence, planned expenditure is the sum of the investment demand of firms and net exports; demand for investment being a negative function of interest rates. Aggregate demand is thus given by:[22]

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[22] For similar specifications see Bernanke and Blinder (1988) and Romer (1999).

$$(9) \qquad y_i^D = -g_i\left(r + r_i^L\right) + NX_i + z_i$$

where z_i denotes an output shock in region i. In order to simplify the analysis, we assume that the elasticity of output with regard to changes in interest rates (g_i) to be the same for the loan and the bond rate. Notice that the demand for investment is expressed as a function of interest rates only, which are related to output through the equilibrium condition on the loan market.

Since neither the nominal exchange rate nor (regional) central bank reserves can change in a monetary union, private net foreign investments (NFA_i) must equal the current account balance: $NFI_i \equiv NX_i$. Net capital flows and net exports are thus linked through a standard balance of payments mechanism: An increase in net foreign assets (exports of capital) implies that domestic savings exceed domestic investment. The excess supply of (investment) goods on the home market is sold on the foreign goods market, which results in a current account surplus. Similarly, imports of capital (domestic investment in excess of domestic savings) implies a deficit in the current account because investment goods are imported.

4 Equilibrium and Comparative Statics

The above model is solved in two steps. First, we derive the optimal portfolio choices of banks, given the reaction of households and firms while assuming output to be exogenous. This allows us to derive the economy's net foreign assets and equilibrium interest rates. In a second step, we are using the results from the optimization of the financial sector to derive the equilibrium conditions on the domestic and foreign output market.

4.1 Financial Market Equilibrium

The optimization problem of the representative domestic bank involves choosing the optimal amount of foreign and domestic loans (deposits). Implicitly, this also defines the size of the bank (A_i) and the amount of bonds the bank holds. We thus use the bank's balance sheet constraint (4) to replace $B_i^{D,B}$ in the bank's profit function (5):

$$(5') \qquad \Pi_i = r_i^L L_{i,i}^S + \left(r_j^L - c_i\right) L_{i,j}^S + r\left(D_{i,i}^D + D_{i,j}^D - L_{i,i}^S - L_{i,j}^S\right) - r_i^D D_{i,i}^D - \left(r_j^D + c_i\right) D_{i,j}^D$$

While we assume that banks take domestic and foreign output as exogenous, interest rates are endogenous to the banks' optimization problem. We assume that banks behave as Cournot oligopolists, taking also the optimal response of the foreign banks into consideration, and optimizing with respect to quantities.

Substituting the inverse deposit supply and loan demand functions:

$$(2') \qquad r_i^D = r + \frac{D_i^S - a_i y_i - m_i}{b_i}$$

$$(3') \qquad r_i^L = r - \frac{L_i^D + e_i y_i + w_i}{t_i},$$

as well as the market-clearing conditions for deposits (1b) and loans (1a) into the banks objective function (6), we obtain the following set of first order conditions for domestic banks:[23]

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[23] Throughout the paper, we assume that the second order conditions for a profit maximum are met, i.e. that $f_{xx}, f_{yy} < 0, \quad f_{xx} \cdot f_{yy} > f_{xy}^2$ holds.

(10a) $$\frac{\partial U_i}{\partial L_{i,i}} = \frac{e_i y_i + w_i - 2L_{i,i} - L_{j,i}}{t_i} - f_i s_{Lii} = 0$$

(10b) $$\frac{\partial U_i}{\partial L_{i,j}} = -c_i + \frac{e_i y_i + w_j - 2L_{i,j} - L_{j,j}}{t_j} - f_i s_{Lij} = 0$$

(10c) $$\frac{\partial U_i}{\partial D_{i,i}} = \frac{a_i y_i + m_i - 2D_{i,i} - D_{i,j}}{b_i} - f_i s_{Dii} = 0$$

(10d) $$\frac{\partial U_i}{\partial D_{i,j}} = -c_i + \frac{a_j y_j + m_j - 2D_{i,j} - D_{j,j}}{b_j} - f_i s_{Dij} = 0$$

where the portfolio effects are given by, for instance, s_{Lii} as the derivative of portfolio risk with respect to the amount of loans supplied by the domestic bank at home. In order to keep the analysis tractable and to be able to derive an explicit solution to this optimization problem, we will, in the following, ignore second-order effects which arise from the feedback effects on portfolio choices among the bank's assets and liabilities. Since a similar set of first order conditions can be derived for the foreign banks, we obtain a set of eight equations which we can, under this assumption, solve simultaneously to obtain a unique interior solution. Adding up loan supply and deposit demand of domestic and foreign banks, we obtain the equilibrium supply of loans and the equilibrium demand for deposits as:

(11a) $$\hat{L}_i = \hat{L}_{i,i} + \hat{L}_{j,i} = \frac{2}{3}\left(e_i y_i + w_i\right) - \frac{1}{3} t_i \left(c_j + s_{Lii} f_i + s_{Lji} f_j\right)$$

(11b $$\hat{L}_j = \hat{L}_{i,j} + \hat{L}_{j,j} = \frac{2}{3}\left(e_j y_j + w_j\right) - \frac{1}{3} t_j \left(c_i + s_{Lij} f_i + s_{Ljj} f_j\right)$$

(11c) $$\hat{D}_i = \hat{D}_{i,i} + \hat{D}_{j,i} = \frac{2}{3}(a_i y_i + m_i) - \frac{1}{3} b_i \left(c_j + s_{Dii} f_i + s_{Dji} f_j\right)$$

(11d) $$\hat{D}_j = \hat{D}_{i,j} + \hat{D}_{j,j} = \frac{2}{3}(a_j y_j + m_j) - \frac{1}{3} b_j \left(c_i + s_{Dij} f_i + s_{Djj} f\right)_j$$

An increase in the demand for loans (w) increases the equilibrium amount of lending whereas a positive shock to the supply of deposits (m) increases the equilibrium amount of deposits. Likewise, an increase in output raises the amount of loans and deposits. Higher costs of cross-border financial transactions have a dampening effect on the supply of loans and the demand for deposits, the strength of this effect being determined by the interest elasticities of loan demand and deposit supply.

Notice that, by choosing these optimal quantities, the choice between bonds and banking assets and liabilities has already been taken into account, i.e. for instance $\hat{L}_i = \hat{L}_i\left(\hat{B}_i\right)$. Hence, we have implicitly also derived the optimal supply of and demand for bonds.

We can use these results to derive the interest rate differentials on retail markets as a function of the structural parameters of the economies and the degree of risk aversion of commercial banks:

$$r_i^L - r_j^L = \frac{1}{3}\left[\frac{1}{t_i}(y_i e_i + w_i) - \frac{1}{t_j}\left(y_j e_j + w_j\right) - c_i + c_j - f_i\left(s_{Lij} - s_{Lii}\right) - f_j\left(s_{Ljj} - s_{Lji}\right)\right]$$

$$r_i^D - r_j^D = \frac{1}{3}\left[-\frac{1}{b_i}(y_i a_i + m_i) + \frac{1}{b_j}\left(y_j a_j + m_j\right) + c_i - c_j - f_i\left(s_{Dii} - s_{Dij}\right) - f_j\left(s_{Dji} - s_{Djj}\right)\right]$$

An increase in the interest elasticity of domestic borrowers (t_i) because of, for instance, improved access to alternative financial sources, tends to lower the gap between domestic and foreign interest rates. Imposing regulations on the activities of foreign banks and thus raising the variable costs of foreign banks to do business on the home market will lead to higher interest rate spreads in the country which imposes the controls (through higher lending and lower deposit rates).

The equilibrium conditions on the markets for deposits and loans can then be substituted into (8) to obtain net capital assets as

$$\begin{aligned} NFA_i &= L_{i,j} + D_{j,i} - L_{j,i} - D_{i,j} + B_i^{D,H} + B_i^{D,B} - B_i^S = \hat{L}_{i,j} + \hat{D}_{j,i} - \hat{L}_{j,i} - \hat{D}_{i,j} \\ &= \frac{1}{3}\left[2\left(c_i\left(b_j - t_j\right) - c_j\left(b_i - t_i\right)\right) + y_i\left(a_i - e_i\right) - y_j\left(a_j - e_j\right) + m_i - m_j - w_i + w_j\right] \\ &\quad + \frac{1}{3}\left[f_i\left(b_i s_{Dii} + 2b_j s_{Dij} - s_{Lii} t_i - 2s_{Lij} t_j\right) - f_j\left(2b_i s_{Dji} + b_j s_{Djj} - 2s_{Lji} t_i - s_{Ljj} t_j\right)\right] \end{aligned} \tag{8'}$$

As regards autonomous shifts in the supply of deposits and loan demand, the results are intuitive: net capital outflows increase (fall) if the domestic (foreign) supply of deposits increases and fall (increase) if the domestic (foreign) demand for loans increases. The response of capital flows with respect to output depends on the relative output elasticities of deposit supply and loan demand: capital outflows increase in domestic income if the supply of deposits is more income-elastic than the demand for loans, and vice versa.

Finally, equation (8') shows that both the degree of capital mobility (measured through the costs of providing financial services abroad) and differences in financial structures have an impact on net capital flows. Assuming that domestic and foreign financial firms face the same costs of cross-border financial transactions $\left(c_i = c_j = c\right)$, net capital outflows increase as transaction costs are lowered if: $b_i - b_j > t_i - t_j$. If loan demand in country i is relatively interest-inelastic because,

for instance, the presence of a less developed bond market, capital flows increase as a response to lower costs of cross-border transactions only if the interest rate elasticity of the domestic supply of deposits is relatively high.

4.2 Output Market Equilibrium

Having solved for the equilibrium levels of interest rates and net capital flows, we can substitute these results into the equilibrium condition for the domestic output market. For this purpose, we substitute the equilibrium supply of domestic loans (11a) into the inverse demand function for loans (3') and plug the resulting equilibrium lending rate and net capital flows (8') into (1c) to obtain: $\hat{y}_i = -g_i\left(r + \hat{r}_i^L(\cdot)\right) + \hat{NFA}(\cdot)$ Solving for y_i and assuming that banks are risk-neutral (thus suppressing portfolio effects for the banks) yields:

(12)

$$y_i = \frac{t_i\left[3z_i + 2\left[c_i\left(b_j - t_j\right) - c_j\left(b_i - t_i\right)\right] - g_i\left(6r + c_i\right) + y_j\left(e_j - a_j\right) - m_j + m_i + w_j - w_i\right] - g_i w_i}{e_i g_i + t_i\left(3 - a_i + e_i\right)}$$

Notice that the denominator of this term is always positive if the income elasticity of deposit demand is sufficiently small $\left(3 - a_i + e_i\right) > 0$. Since empirical studies tend to find income elasticities of money demand in the order magnitude of one, [24] we will in the following assume that this condition holds.

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[24] See Bruggeman (2000) for a recent survey.

4.3 Comparative Statics

Having solved for the equilibrium volume of output, we are now in the position to derive the comparative static effects of changes in the model's exogenous parameters (demand shocks, changes in the degree of capital mobility as measured by c, changes in financial structures, and monetary policy shocks) on output.

4.3.1 Demand Shocks

In a first step, we are interested in the question to what extent foreign demand shocks (such as an increase in government spending) spill over into the domestic economy and how this is affected by differences in financial structures or the degree of capital mobility. Upon noting that a similar relationship as given by (12) for domestic output also prevails for foreign output, we obtain a set of two equations which can be solved simultaneously for $\hat{y}_i$ and $\hat{y}_j$. Using the result for y_i and differentiating with respect to a foreign output shock z_j yields:

(13)

$$\frac{\partial y_i}{\partial z_j} = -\frac{3t_i t_j (a_j - e_j)}{t_i e_j g_j (3 + e_i - a_i) + e_i g_i t_j (3 + e_j - a_j) + 3t_i t_j (3 + e_i + e_j - a_i - a_j) + e_i g_i e_j g_j}$$

Under our maintained assumption that the income elasticity of deposit demand takes a value of about one, the denominator of this term is always positive. The sign of (13) thus depends on the relative income elasticities of deposit supply and loan demand on the foreign market. If deposit supply is relatively income elastic ($a_j > e_j$), domestic output is related negatively to foreign output. The reason for this negative link is that, following a positive shock to foreign output, foreign households increase their savings held in form of deposits by more than the induced increase in investment abroad. The domestic economy would become a net importer of foreign capital, which would correspond to a decline in net exports of goods. A positive link is, to the contrary, obtained if foreign deposit supply is relatively income inelastic.

In the following comparative static analysis, we will ignore indirect effects that occur through changes in foreign income and consider direct effects of changes in the model's exogenous parame-

ters on domestic income only. If the standard second order conditions are met, this partial analysis in fact remains valid even if we allowed for repercussions to occur.

4.3.2 Increased Capital Mobility

The implementation of the Second Banking Directive in the early 1990s and, more recently, the introduction of the Euro are commonly believed to have lowered the costs of cross-border financial transactions in Europe. From (9), we have already seen that this reduction in transaction costs has a positive impact on the cross-border lending of commercial banks. The corresponding output effects depend on the interest elasticities of deposit supply and loan demand:

$$\frac{\partial y_i}{\partial c_i} = -\frac{2t_i\left(t_j - b_j\right)}{e_i g_i + t_i\left(3 - a_i + e_i\right)}$$

$$\frac{\partial y_i}{\partial c_j} = -\frac{2t_i\left(b_i - t_i\right) + g_i t_i}{e_i g_i + t_i\left(3 - a_i + e_i\right)} \qquad (14)$$

Lower costs of cross-border financial transactions for domestic banks raise domestic output if foreign deposit supply is relatively interest-inelastic ($t_j > b_j$). The intuition behind this result is straight-forward. If the foreign supply of deposits is interest inelastic, domestic banks increase their foreign assets by more than their foreign liabilities, which corresponds to a net capital outflow. This capital outflow corresponds to a current account surplus. The reverse holds true if the supply of deposits on the foreign market is relatively interest-elastic. Conversely, lower transaction costs for foreign commercial banks increase domestic output if domestic deposit supply is relatively interest-elastic ($t_i < b_i$), as this will lead to an increase in net foreign assets. Assuming that domestic and foreign banks face the same costs of cross border transactions $\left(c_i = c_j = c\right)$, the net

output effect of increasing the degree of market integration will thus depend on the relative structure of financial markets.

In order to check to what extent changes in capital mobility affect aggregate output, we have again solved for y_i and y_j simultaneously and have made the additional simplifying assumption that the countries are completely symmetric. Hence, we can drop all subscripts. This gives the derivative of total output with respect to the costs of cross-border transactions as:

$$(14') \qquad \frac{\partial y}{\partial c} = -\frac{gt}{eg + 3t}$$

Aggregate output will increase if the costs of cross-border financial transactions decline, and the strength of this effect depends, inter alia, on the interest elasticity of loan demand. If firms can switch easily between loans and bonds (high t), the larger will be the output effect of changes in c.

4.3.3 Changes in Financial Structures

In addition to lower transaction costs, financial market integration can also be expected to lead to changes in the financial structures of firms. As financial markets become more integrated and as alternative sources of finance become available more easily, the interest elasticity of loan demand is likely to increase. An increase in the interest elasticity of loan demand abroad has a negative effect on domestic output if financial markets are incompletely integrated ($c_i \neq 0$) and if differences in the implied portfolio effects for domestic and foreign banks are not too large:

$$(15) \qquad \frac{\partial y_i}{\partial t_j} = -\frac{t_i\left(2c_i + 2s_{Lij}f_i - s_{Ljj}f_j\right)}{e_i g_i + t_i\left(3 - a_i + e_i\right)}$$

This negative effect results from the fact that a higher interest elasticity of foreign loan demand lowers net foreign assets of domestic commercial banks, and the resulting capital inflow is offset by a current account deficit. Also, the strength of the negative output effect depends on the costs of cross-border financial transactions and thus on the degree of integration of the two markets.

4.3.4 Monetary Policy

Assuming that the monetary authorities affect the economy through open market operations and thus changes in the bond rate, the partial equilibrium effect of a restrictive monetary policy on domestic output is negative:

$$(16) \qquad \frac{\partial y_i}{\partial r} = -\frac{6g_i t_i}{e_i g_i + t_i(3 - a_i + e_i)} < 0$$

Obviously, output effects differ across regions, and the higher the elasticity of investment with respect to changes in interest rates, the larger the contractionary effect. Under complete symmetry of countries, the aggregate output effect is given by $\frac{\partial y}{\partial r} = -\frac{2gt}{eg + 3t} < 0$.

5 Information, Distance, and International Lending

The baseline model presented so far has been build on a number of simplifying assumptions. In this section, we extend the model to shed more light on the distinction barriers towards financial market integration which are due to information costs and regulations. Through the variable costs (c) of making loans and raising deposits abroad, we have already captured regulatory barriers. However,

as regulatory barriers are being lifted, these 'technical' transaction costs are loosing in importance. What remains is a segmentation of national financial markets due to the costs of obtaining information on investment projects abroad.

In contrast to the previous section, we now assume that banks can engage in monitoring activities which reduces the riskiness of their assets. The costs of monitoring, in turn, are a function of the 'informational distance' between a bank and its customers. Hereby, the term distance might be interpreted in a geographical sense since monitoring can be expected to be less expensive for borrowers which are located close to the bank. It may, however, also capture other aspects of information costs which are unrelated to geographical distance such as, for instance, the size of firms, which has a bearing on disclosure requirements. To focus on the impact of information costs on cross-border capital flows, we make a number of simplifying assumptions. We, first of all, focus on the lending risks that banks incur only, and thus re-write portfolio risk as

$$(7') \qquad \sigma^2(\Pi_i) = L_{i,i}^2 \sigma_{i,z}^2 + L_{i,j}^2 \sigma_{j,z}^2 + 2\rho L_{i,i} L_{i,j} \sigma_{i,z} \sigma_{j,z}$$

and $COV = \begin{pmatrix} \sigma_{i,z}^2 & \rho \sigma_{i,z} \sigma_{j,z} \\ \rho \sigma_{i,z} \sigma_{j,z} & \sigma_{j,z}^2 \end{pmatrix}$ where $\rho = \rho_{zz}$.

To simplify the analysis, we further assume that foreign assets are more risky than domestic assets ($\sigma_{i,z} > \sigma_{j,z}$) but that banks can reduce the risk of foreign activities by monitoring clients. Hereby, banks can reduce the risks of lending such that the standard deviation of domestic and foreign loans becomes:

$$(17) \qquad \sigma_{i,z} = q^{-m} \qquad \text{with } \frac{\partial \sigma_{i,z}}{\partial q} = -mq^{-m-1} < 0 \text{ and } \frac{\partial^2 \sigma_{i,z}}{\partial q \partial q} = m(1+m)q^{-m-2} > 0$$

where q is the amount of monitoring. Each unit of resources devoted to monitoring involves a variable cost d which we can interpret as the (cultural and/or geographical) distance between a bank and its (foreign) customers. Profits therefore become

(5') $$P_i = r_i^L L_{i,i} + \left(r_j^L - c_i\right)L_{i,j} + r\left(D_{i,i} + D_{i,j} - L_{i,i} - L_{i,j}\right) - r_i^D D_{i,i} - \left(r_j^D + c_i\right)D_{i,j} - dq$$

Finally, we simplify by assuming that banks take deposit and lending rates as given. As before, we can now derive a set of first order conditions for each bank. Under the assumption that deposit-taking is riskless, the bank is indifferent between borrowing at the risk-less rate or raising domestic or foreign deposits. The difference to the baseline-model is thus that we now have three first order conditions for each bank since banks also choose the optimal amount of monitoring:

(18a) $$\frac{\partial U_i}{\partial L_{i,i}} = -r + r_i^L - f_i s_{i,i}\left(rq_i^{-m}L_{i,j} + L_{i,i}s_{i,i}\right) = 0$$

(18b) $$\frac{\partial U_i}{\partial L_{i,j}} = -r + r_j^L - c_i - f_i\left(q_i^{-2m}L_{i,j} + rq_i^{-m}L_{i,i}s_{i,i}\right) = 0$$

(18c) $$\frac{\partial U_i}{\partial q_i} = -d + f_i m\left(q_i^{-1-2m}L_{i,j}^2 + rq_i^{-1-m}L_{i,i}L_{i,j}s_{i,i}\right) = 0$$

Using the implicit function theorem, we can derive the change in the optimal amount of monitoring with respect to distance d from (18c) as: $\frac{\partial q_i}{\partial d} = -\frac{\partial \Pi_i}{\partial_i \partial d}\Big/\frac{\partial^2 \Pi_i}{\partial q_i \partial q_i} = -(-d)\Big/\frac{\partial^2 \Pi_i}{\partial q_i \partial q_i} < 0$ if the second order conditions for a profit maximum are met.

Solving the first two of these equations simultaneously for domestic and foreign banks gives the optimal amount of domestic and foreign lending for the domestic bank as

$$(18a') \quad \hat{L}_{i,i}\big|_{dq=0} = \frac{r_i^L - r - r q_i^m s_{i,i}\left(r_{j,L} - r - c_i\right)}{f_i s_{i,i}^2\left(1 - r^2\right)}$$

$$(18b') \quad \hat{L}_{i,j}\big|_{dq=0} = \frac{q_i^m\left[-r\left(r_{i,L} - r\right) + q_i^m s_{i,i}\left(r_{j,L} - r - c_i\right)\right]}{f_i q_{i,i}^2\left(1 - r^2\right)}$$

Since the denominator of these terms is always positive $(0 < r < 1)$, we obtain the expected responses: lending increases in its own (net) rate of return and declines when the net returns on alternative lending opportunities go up.[25] Since the optimal amount of monitoring is a function of the (informational) distance between the two regions, the intensity of a spill-over of foreign interest rate shocks into the domestic market is a function of the degree of (informational) integration between the two markets: $\frac{\partial \hat{L}_{i,i}}{\partial r_{j,L}} = -\frac{r q(d)_i^m s_{i,i}}{f_i s_{i,i}^2\left(1 - r^2\right)} < 0$

Also, from (18a'), we can obtain the response of foreign assets of domestic banks to a change in distance (and thus in the monitoring costs) between the two countries:

$$(19) \quad \frac{\partial \hat{L}_{i,j}}{\partial d} = \frac{\partial \hat{L}_{i,j}}{\partial q_i}\frac{\partial q_i}{\partial d} = \frac{m q_i^{m-1}\left[r\left(r - r_{i,L}\right) - 2 q_i^m s_{i,i}\left(r + c_i - r_{j,L}\right)\right]}{f_i s_{i,i}^2\left(1 - r^2\right)} \cdot (-1)$$

The lending activities of banks abroad thus decline in distance if $r\left(r_{i,L} - r\right) < 2 q_i^m s_{i,i}\left(r_{j,L} - c_i - r\right)$ holds. Hence, the lower the correlation between domestic and foreign asset returns, the lower the returns on domestic, the higher the (net) returns on foreign assets

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[25] Notice that the change in lending with respect to changes in the bond rate alone depends on the magnitude of the portfolio effects. If $r m_i^m s_{i,i} < 1$, domestic (foreign) lending increases (declines) if the bond rate falls, and vice versa.

and the larger the risk of domestic lending, the more likely is a negative response. At the same time, the more costly it is in informational terms to enter a foreign market, the larger will be the lending activities on the domestic market:

$$(20) \qquad \frac{\partial \hat{L}_{i,i}}{\partial d} = \frac{\partial \hat{L}_{i,i}}{\partial q_i}\frac{\partial q_i}{\partial d} = \frac{-mrq_i^{m-1}s_{i,i}\left(r_{j,L} - c_i - r\right)}{f_j s_{j,j}^2\left(1-r^2\right)}\cdot(-1) > 0$$

Deriving formulas similar to (18a') and (18b') for the foreign bank, we obtain net foreign assets as:

$$(21) \qquad \begin{aligned} NFA_i &= L_{i,j} - L_{j,i} \\ &= \frac{q_i^m\left[r\left(r - r_{i,L}\right) - q_i^m s_{i,i}\left(r + c_i - r_{j,L}\right)\right]}{f_i s_{i,i}^2\left(1-r^2\right)} - \frac{q_j^m\left[r\left(r - r_{j,L}\right) - q_j^m s_{j,j}\left(r + c_j - r_{i,L}\right)\right]}{f_i s_{i,i}^2\left(1-r^2\right)} \end{aligned}$$

As before, we can calculate the equilibrium level of domestic and foreign output:

$$\hat{y}_i = -g_i\left(r - \frac{-y_i e_i - t_i r - w_i + \hat{L}_{i,i} + \hat{L}_{j,i}}{t_i}\right) + z_i + N\hat{F}A_i$$

Substituting the solutions for lending and net foreign assets, this equation can be solved for the equilibrium level of domestic output ($\hat{y}_i$). Under the assumption that the two countries are completely symmetric, we obtain the following response of output in region i to an increase in distance between the two regions:

(22)

$$\left.\frac{\partial \hat{y}_i}{\partial d}\right|_{dr=0} = \left(\frac{\partial \hat{y}_i}{\partial_i} + \frac{\partial \hat{y}_i}{\partial q_j}\right)\cdot\frac{\partial q_i}{\partial d} = \frac{-2mgq^{m-1}\left[\left(r_L - r\right)\left(r - q^m s\right) - c\left(\frac{1}{2}r - q^m s\right)\right]}{\left(1-r^2\right)(ge+t)fs}\cdot(-1) < 0$$

where s denotes the standard deviation of domestic lending. Since, $0 < r < 1$ the round brackets in the enumerator are positive if the product of the standard deviations of domestic and foreign loans ($q^m s$) exceeds one. Under these parameter constellations, domestic output declines if the (informational) distance between the two regions increases. Since a symmetric result can be derived also for foreign output, we obtain a negative response of aggregate output with regard to a segmentation of financial markets which arises from higher information costs.

One reason why we obtain these results is that, so far, we have treated the correlation between asset returns as exogenous. However, in order to derive the full implications of changes in the degree of financial integration on output, this additional effect must be taken into account:

$$(22') \qquad \frac{\partial \hat{y}_i}{\partial d} = \left(\frac{\partial \hat{y}_i}{\partial q_i} + \frac{\partial \hat{y}_i}{\partial q_j} \right) \cdot \frac{\partial q_i}{\partial d} + \frac{\partial \hat{y}_i}{\partial r} \frac{\partial r}{\partial d}$$

where the reaction of output with regard to changes in return correlations is given by

$$\frac{\partial \hat{y}_i}{\partial r} = g \, \frac{2(r_L - r)\left[(1 + q^m r s)(r - q^m s)\right] + c\left[1 + r\left(r - 2q^m s\right)\right]}{(r-1)^2 (ge + t) f s^2} < 0$$

where the first term in the numerator is negative. If the costs of cross-border transactions are sufficiently small and/or if the last term in squared brackets in the numerator is negative as well, domestic output is thus a negative function of the correlation of asset returns. The reason for this result is that higher asset return correlations dampen the diversification effects of foreign lending and thus lower domestic lending as well. Therefore, the additional effect that lower information costs have for domestic output depends on the link between distance and return correlations. If correla-

tions decline as information costs increase ($\frac{\partial r}{\partial d} < 0$), the negative impact which works through the monitoring activities of banks may partially be offset.

Now, the degree of (financial) integration is likely to have implications for the structure of the real sector and the correlation of shocks across countries. However, the direction of this link is not clear from a theoretical perspective and remains essentially an empirical issue.

On the one hand, Frankel and Rose (1998) have argued that countries which are more interlinked in terms of bilateral trade are likely to have closer business cycle correlations as common demand shocks become more likely and as intra-industry trade becomes more important. They conjecture that increased trade links in Europe would cause a greater degree of integration of the real economy (and thus improve the conditions for having a common currency). Although this argument is not related directly to the degree of capital market integration, re-phrasing it accordingly is not very difficult since there is a substantial amount of evidence that financial linkages between countries are closely related to trade links. According to this view, return correlations would thus increase in more integrated financial markets.

On the other hand, by increasing the possibilities for interregional risk-sharing, financial market integration (or increased trade integration) potentially promote the division of labor across regions and could thus lower the correlation of regional shocks.

Contrary to this, most models of international financial markets assume that the correlation of real shocks, which determines the benefits from diversification, is independent from the degree of financial market integration. Rather, in these models, causality runs from the degree of integration of the real economy (measured in terms of return correlations) to the degree of integration of the fi-

nancial sector. Recent empirical evidence, however, suggests that the direction of causality might just be the reverse. Kalemli-Ozcan et al. (2000) show that the degree to which the financial system is conducive to risk-sharing among regions affects the degree of industrial specialization. Their empirical results support a positive correlation between the degree of financial integration among regions (or countries) and the degree of specialization in industrial production. They find risk sharing to be substantially higher among regions within countries (such as the US) rather than among groups of countries (such as Euroland). The difference in terms of industrial specialization is not quite as pronounced but still significant.

In the notation of our model, the correlation of asset returns would, in this scenario, depend posetively on distance and on the costs of cross-border financial transactions: $r = r(d,c)$ with $\frac{\partial r}{\partial c}, \frac{\partial r}{\partial d} > 0$. The more integrated financial markets (lower c or d), the lower is ceteris paribus the correlation of returns because of the increased degree of specialization in production. In this case, the positive effect that financial integration would have on output through reduced monitoring costs would thus be reinforced through the negative effect on return correlations. If, however, integration processes lead to a greater degree of co-movements of business cycles, the positive effect would partially be offset through the higher return correlations and lower diversification benefits.

Finally, we can derive the response of domestic output with respect to changes in the bond rate as

$$(16') \qquad \frac{\partial y_i}{\partial r} = \frac{g\left[1 - 2\left(q^m r s - s^2 t f + r^2 s^2 t f\right) + q^{2m} s^2\right]}{-\left(1 - r^2\right) s^2 (ge + t) f}$$

Hence, in contrast to the analysis above, the output response to a change in the bond rate and thus to monetary policy changes depends not only on the structure of the financial system but also on the degree of integration of financial markets. While the denominator in (16') is always negative, the sign of the numerator is undetermined a priori. We obtain a negative output response to increases in the bond rate if returns are uncorrelated since $1+2\sigma^2\tau\varphi+\varphi^{2m}\sigma^2<0$ but the response might even be positive if return correlations are highly positive.

6 Possible Extensions

The model that we have presented so far has made some fairly stylized assumptions concerning both, the nature of competition in banking and the underlying structure of the macro-economy. In this section, we therefore review briefly some recent contributions to the literature which address these aspects.

As regards the macro-economic set-up, a critical assumption that we have made has been to consider a two-country setting only with exchange rates being fixed between the two markets. A more realistic set-up would be to consider a three-country framework in which two countries form a monetary union but have a floating exchange rate regime with respect to the rest of the world. Incidentally, such a specification would be closer to the reality of the European Monetary Union. In a three-country model, incentives for portfolio diversification would arise not only from the potential for cushioning the impact of domestic money demand and productivity shocks. Rather, exchange rate risks and their correlations with the remaining shocks would also play a role. Clausen and Wohltmann (2000) have such a three-country model but do not consider portfolio effects or in-

complete mobility of capital. Increasing the number of countries would, incidentally, also allow us to analyze the case discussed by Allen and Gale (2000) of different degrees of financial integration.

In addition, it has been argued that the standard open-economy macroeconomic model in the spirit of Mundell and Fleming that we have employed here is ill-suited to take intertemporal choices of households (and firms) into account and does not specify the underlying microstructure of the economy. Hence, a new class of models has been developed which introduce nominal rigidities and imperfect competition on the production side into dynamic general equilibrium models.[26] Yet, while work in this field is more sophisticated than traditional models with regard to the intertemporal choices of households and the competitive structure of industries, the financial sector is typically not modeled explicitly.

Recent contributions deal with the implications of these models for net capital flows and shed more light on the structure of financial markets in these models. Bacchetta and van Wincoop (2000) use a two-country, two-period model and assume that the domestic discount rate exceeds the foreign one. This asymmetry raises the domestic over and above the foreign savings rate and creates the potential for net capital (out)flows. Capital flows are facilitated through trade in domestic and foreign bonds, and there are no frictions on financial markets. The authors show that real interest parity holds in the sense that the real interest rate on domestic bonds equals the risk-adjusted rate of return on foreign bonds. Furthermore, an increase in domestic savings leads to a decline in the world interest rate. The magnitude of net capital flows, in turn, depends on the preference that domestic residents have for domestic bonds. The more pronounced this preference, the lower are net capital flows.

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[26] Work in this field largely builds on Obstfeld and Rogoff (1996) and has been surveyed recently by Lane (2001).

Although the model by Bacchetta and van Wincoop (2000) has the advantage of incorporating capital flows into an international macro-model, capital markets are yet assumed to be integrated fully. Sutherland (1996) departs from this assumption by introducing costs of trading international bonds, which drives a wedge between domestic and foreign interest rates. The implications of this model are that financial integration leads to lower short-run volatility due to labour supply or demand shocks. The effects of monetary shocks, in contrast, differ. Under financial integration, monetary shocks cause larger volatility of the nominal exchange rate and of output but lower volatility of interest rates and consumption. In an extension, which combines the assumption of incomplete integration of financial markets with pricing-to-market behavior and thus imperfect integration of goods markets, Senay (1998) shows a limited degree of interaction between financial and real integration in determining the macroeconomic effects of shocks. However, none of these models goes into much detail concerning the precise friction on financial markets or the interaction between imperfect goods and financial market interaction.

An additional simplifying assumption that we have made concerns the nature of competition in the banking sector. Although we have assumed that the marginal costs of domestic and foreign banks differ due to the presence of transaction costs in cross-border lending, we have not distinguished between domestic and foreign banks according to their degree of market power. Rather, banks have acted as Cournot duopolist, taking into consideration the optimal supply and demand responses of their competitors. A more realistic assumption would be that domestic banks enjoy a 'first-mover' advantage on the domestic market and can behave as Stackelberg leaders. With loans supplied by domestic and foreign banks being substitutes — as the present model assumes — the amount of loans supplied by domestic banks would be larger than under Cournot-competition while

that of foreign banks would be lower (Buch and Golder 2001), thus dampening the magnitude of capital flows.

Also, recent contributions have assumed that banks behave as monopolistic competitors. The interesting feature about these models is that they explicitly incorporate distance into the analysis. In a baseline specification discussed in Freixas and Rochet (1998), increased distance raises the costs of depositors to reach the bank. Hence, it can be thought of in terms of physical transportation costs. Hauswald and Marquez (2000), to the contrary, interpret distance in terms of an 'informational' distance between banks and their customers. In their model, banks compete in information space with both informed and uninformed competitors. One implication of their model is that increased competition induces banks to focus on their core business and on relationship lending. In terms of the above model, this would imply that banks would focus their activities on their home-country market, which would again lower capital flows.

Finally, the model could be extended to show the implications of financial integration on the efficiency of financial intermediation. In the literature, the possibility that increased integration and increased competitive pressure might also lead to greater instabilities in the financial sector has been discussed. These negative effects of integration can arise through two channels. First, increased competition puts pressure on the incumbent financial institutions, lowers their interest rate spreads, and might thus reduce incentives to monitor borrowers (Aizenman 1998, Gehrig 1998). Second, increased integration of financial markets might increase the probability that adverse shocks in one country spill over into other countries. This might necessitate the establishment of a common supervisory authority which monitors financial market developments in all members of a

monetary union. Incidentally, applications of these insights to the present set up might thus contribute to the debate on the appropriate design of supervisory systems in Euroland.[27]

7 Conclusions

The aim of this paper has been to provide a simple framework suited to analyze financial sector linkages in a monetary union. We have focused on two aspects which distinguish Euroland from a national monetary union such as the United States. First, the model has captured the fact that the degree of interregional capital mobility in Europe is lower than in a national monetary union and that individual financial markets segments differ with regard to their degree of integration. Interregional capital flows are intermediated through commercial banks, which face variable costs of cross-border financial transactions. Bond markets, to the contrary, are assumed to be integrated fully. Second, the interest rate elasticities of regional deposit supply and loan demand have been allowed to differ, reflecting the fact that financial market structures and institutions are not homogenous across Europe.

The comparative static analysis of this framework shows that an increase in the bond rate lowers both regional and aggregate output while the strength of this effect depends on regional factors. Other comparative static effects depend on financial market structures and the relative interest- and output-elasticities of deposit demand and loan supply. The inter-regional spill-over of demand shocks is, for instance, positive only if deposit supply is more elastic with respect to output than

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[27] See, e.g. Bini Smaghi and Gros (2000).

loan demand. Also, the strength of the propagation effect depends upon the interest elasticities of loan demand at home and abroad.

Increased capital mobility unambiguously raises domestic output if interest elasticities at home and abroad are similar, that is if financial market structures do not differ much. A positive response of aggregate output is likely if the interest elasticity of output is high. As financial markets develop, the interest elasticity of loan demand is likely to increase because more alternative sources of finance become available. This, in turn, will lead to a positive response of aggregate output if the costs of cross-border financial transactions are low and thus if capital mobility is high.

In an extension of the baseline model, we have focused on information costs as one factor which segments financial markets. By modeling monitoring activities of banks explicitly, we have shown that output tends to be a positive function of the degree of integration of markets (measured through their 'informational' distance). However, positive output effects of increased financial integration might partially be offset if increased integration leads to a greater correlation between real business cycles.

In summary, the results of this paper show that countries might benefit from increased capital mobility to different degrees, depending on the structure of their financial systems. Generally, this might explain the reluctance of some countries to abolish indirect restrictions to a full integration of financial markets even though the aggregate effects of integration might be positive.

8 References

Aghion, P., P. Bacchetta, and A. Banerjee (2000). Currency Crises and Monetary Policy in an Economy with Credit Constraints. Harvard University, University of Lausanne, and MIT. mimeo.

Aizenman, J. (1998). Capital Mobility in a Second Best World — Moral Hazard with Costly Financial Intermediation. National Bureau of Economic Research (NBER). Working Paper 6703. Cambridge, MA.

Allen, F., and D. Gale (2000). Financial Contagion. *The Journal of Political Economy* 108 (1): 1–33.

Arnold, I.J.M., and C.G. de Vries (2000). Endogenous Financial Structure and the Transmission of ECB Policy. In: von Hagen (ed.). *Regional Aspects of Monetary Policy in Europe*. Boston (Kluwer Academic Publishers). 193–218.

Atkeson, A., and T. Bayoumi (1993). Do Private Capital Markets Insure Regional Risk? Evidence from the US and Europe. *Open Economies Review* 4: 303–324.

Bacchetta, P., and E. van Wincoop (2000). Does Exchange Rate Stability Increase Trade and Capital Flows? *American Economic Review* 90, 5, S. 1093–1109.

Baltensperger, E., and H. Milde (1987). *Theorie des Bankverhaltens*. Berlin.

Bank for International Settlements (BIS) (2001). *70th Annual Report*. Basle.

Berger, A.N., R. DeYoung, and G.F. Udell (2000). Efficiency Barriers to the Consolidation of the European Financial Services Industry. *European Financial Management* 6 (forthcoming).

Bernanke, B.S., and A.S. Blinder (1988). Credit, Money, and Aggregate Demand. *American Economic Review* 78(2): 435–439.

Bini Smaghi, L., and D. Gros (2000). *Open Issues in European Central Banking*. London (Macmillan).

Bruggeman, A. (2000). The First Pillar of the Single Monetary Policy and its Economic Underpinning: Long-Term Money Demand in the Euro-Area. *Revue de la Banque* (2-3): 84–90.

Buch, C.M. (2000). Information or Regulation: What is Driving the International Activities of Commercial Banks? *Kiel Working Paper* 1011. Kiel.

Buch, C.M. (2001). Financial Integration in the US – Lessons for Europe? *Comparative Economic Studies* (forthcoming).

Buch, C.M. and S.M. Golder (2001a). Domestic and Foreign Banks in Germany: Do They Differ? *Kiel Working Paper* 986. Kiel. and in *Kredit und Kapital*. Forthcoming.

Buch, C.M. and R.P. Heinrich (1999). Twin Crises and the Intermediary Role of Banks. *International Journal of Finance and Economics* 4: 313–323.

Carlino, G., and R. DeFina (1998). Monetary Policy and the U.S. States and Regions: Some Implications for the European Monetary Union. Federal Reserve Bank of Philadelphia. Working Paper 98-17.

Cecchetti, S.G. (1999). Legal Structure, Financial Structure, and the Monetary Policy Transmission Mechanism. National Bureau of Economic Research (NBER). Working Paper 7151. Cambridge, MA.

Centeno, M., and A.S. Mello (1999). How Integrated are the Money Market and the Bank Loans Market Within the European Union? *Journal of International Money and Finance* 18: 75–106.

Cespedes, L.F., R. Chang, and A. Velasco (2000). Balance Sheets and Exchange Rate Policy. National Bureau of Economic Research (NBER). Working Paper 7840. Cambridge MA.

Ciccarelli, M., and A. Rebucci (2001). The Transmission Mechanism of European Monetary Policy: Is There Heterogeneity? Is It Changing over Time? University of Alicante and International Monetary Fund. mimeo.

Clausen, V., H.-W. Wohltmann (2000). Monetary and Fiscal Policy Dynamics on an Asymmetric Monetary Union. University of Kiel and University of Indiana, Bloomington. Mimeo.

Danthine, J.-P., F. Giavazzi and E.-L. von Thadden (2000). European financial markets after EMU: a first assessment. Centre for Economic Policy Research (CEPR). Discussion paper 2413. London.

De Bondt, G.J. (2000). *Financial Structure and Monetary Transmission in Europe: A Cross-Country Study*. Cheltenham (Edward Elgar)

De Haan, J., L.A. Toolsema, and J.-E. Sturm (2001). Convergence of Monetary Transmission in EMU New Evidence. Center for Economic Studies and Ifo Institute for Economic Research. University of Groningen. CESifo Working Paper Series No. 465.

Deutsche Bundesbank (2000). *Zahlungsbilanzstatistik*. November. Frankfurt a.M.

Dornbusch, R., C. Favero, and F. Giavazzi (1998). Immediate Challenges for the European Central Bank. *Economic Policy* 26: 17–64.

Driscoll, J.C. (2000). Does Bank Lending Affect Output? Evidence From the U.S. States. Browne University. October. Mimeo.

Favero, C.A., F. Gavazzi, and L. Flabbi (1999). The Transmission Mechanism of Monetary Policy in europe: Evidence from Bank's Balance Sheets. National Bureau of Economic Research (NBER). Working Paper W7231. Cambridge MA.

Frankel, J.A., and A.K. Rose (1998). The Endogeneity of the Optimum Currency Area Criteria. *The Economic Journal* 108(449): 1009–1025.

Fratzscher, M. (2001). Financial Market Integration in Europe: On the Effects of EMU on Stock Markets. European Central Bank. Working Paper 48. March. Frankfurt a.M.

Freixas, X., and J.-C. Rochet (1998). *Microeconomics of Banking*. Cambridge (MIT Press).

Freixas, X., and C. Holthausen (2000). Inter-bank Liquidity Channels and the Creation of a Unique Market in EU. University Pompeu Fabra and European Central Bank. mimeo.

Freixas, X., B.M. Parigi, and J.-C. Rochet (2000). Systemic Risk, Interbank Relations, and Liquidity Provision by the Central Bank. *Journal of Money, Credit, and Banking* 32(3): 611–638.

Gehrig, T. (1998). Screening, Cross-Border Banking, and the Allocation of Credit. Centre for Economic Policy Research (CEPR). Working Paper 1973.

Giovannetti, G., and R. Marimon (2000). An EMU with Different Transmission Mechanisms? In: von Hagen (ed.). Regional Aspects of Monetary Policy in Europe. Boston (Kluwer Academic Publishers). 159–191.

Hauswald, R., and R. Marquez (2000). Relationship Banking, Loan Specialization and Competition. Kelley School of Business (Indiana University) and Robert H. Smith School of Business (University of Maryland). mimeo.

Heinrich, R.P. (2001). *Complementarities in Corporate Governance*. Kiel Institute of World Economics. Kiel Study. Forthcoming.

Hess, G.D., and K. Shin (2000). Risk sharing by households within and across regions and industries. *Journal of Monetary Economics* 45: 533–560.

Kakes, J. (2000). *Monetary Transmission in Europe — The Role of Financial Markets and Credit*. Edward Elgar (Cheltenham).

Kalemli-Ozcan, S., B.E. Sorensen, and O. Yosha (2000). Risk Sharing and Industrial Specialization: Regional and International Evidence. Federal Reserve Bank of Kansas City. Research Division. Working Paper RWP 00-06.

Kleimeier, S., and H. Sander (2000). Regionalisation versus Globalisation in European Financial Market Integration: Evidence from co-integration analyses. *Journal of Banking and Finance* 24: 1005–1043.

Lahiri, A., and C.A. Vegh (2000). Delaying the inevitable: optimal interest rate policy and BOP crises. National Bureau of Economic Research. Working Paper 7734. Cambridge, MA.

Lane, P.R. (2001). The New Open Economy Macroeconomics. *Journal of International Economics*. Forthcoming.

Lemmen, J. (1998). *Integrating Financial Markets in the European Union.* Cheltenham and Northhampton (Edward Elgar).

Loayza, N., K. Schmidt-Hebbel and L. Serven (2000). What drives private saving across the world?. *The Review of Economics and Statistics* 82(2): 165–181.

Martin, P., and H. Rey (2001). Financial Super-Markets: Size Matters for Asset Trade. University of Lille and Princeton University. mimeo.

McPherson, S.H., and C.J. Waller (2000). Intraregional Intergration: Evidence from the Canadian Banking Industry. In: von Hagen, J. (ed.). *Regional Aspects of Monetary Policy in Europe*. Boston (Kluwer Academic Publishers): 69–88

Mishkin, F.S. (1996). The Channels of Monetary Transmission: Lessons for Monetary Policy. National Bureau of Economic Research (NBER). Working Paper 5464. Cambridge MA.

Obstfeld, M, and K. Rogoff (1996). *Foundations of International Macroeconomics*. MIT Press (Cambridge MA).

Peek, J. and E. S. Rosengren (1997). The International Transmission of Financial Shocks: The Case of Japan. *American Economic Review* 87 (4): 495–505.

Peek, J., and E.S. Rosengren (2000). Collateral Damage: Effects of the Japanese Bank Crisis on Real Activity in the United States. *American Economic Review* 90(1): 30–45.

Peersman, G. (2000). The Transmission of Monetary Policy in the Euro-Area. *Revue de la Banque* 2–148.3: 139–148.

Portes, R., and H. Rey (1999). The Determinants of Cross-Border Equity Flows. National Bureau of Economic Research. Working Paper 7336. Cambridge MA.

Rødseth, A. (2000). *Open Economy Macroeconomics*. Cambridge University Press (Cambridge).

Romer, D. (1999). Short-Run Fluctuations. University of California. Berkeley. www.berkeley.edu. mimeo

Schmidt, R.H., A. Hackethal, and M. Tyrell (1999). Disintermediation and the role of banks in Europe: an international comparison. *Journal of Financial Intermediation* 8(1/2): 36–67.

Senay, O. (1998). The Effects of Goods and Financial Market Integration on Macroeconomic Volatility. *The Manchester School Supplement* 66: 39–61.

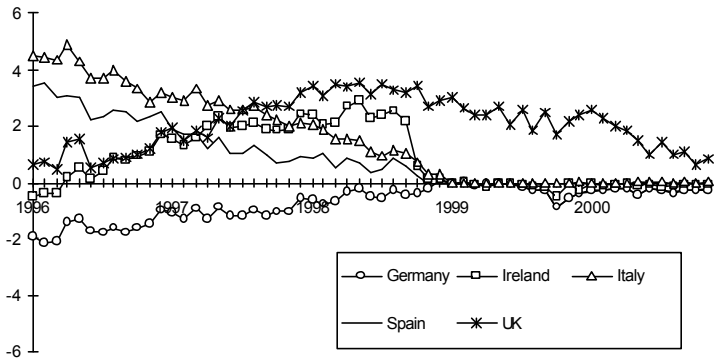
Sutherland, A. (1996). Financial Market Integration and Macroeconomic Volatility. *Scandinavian Journal of Economics* 98: 129–539.

Van Rijckeghem, C., and B. Weder (2000). Spillovers Through Banking Centers: A Panel Data Analysis. International Monetary Fund. Working Paper 00/88. Washington DC.

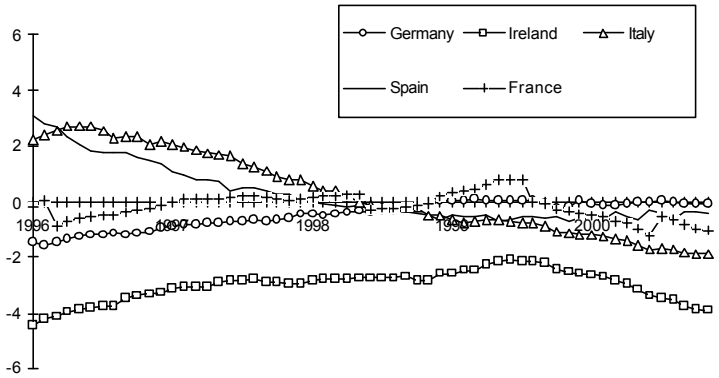
Graph 1 — Differences in Interest Rates in Selected European Countries, 1996–2000

The graphs give the difference between national interest rates and the Euroland average rate. All data have been taken from the International Financial Statistics of the IMF, lines 60B (money market rates), 60L (deposit rates), and 60P (lending rates). The choice of countries has been guided mainly by data availability. Euro-average interest rate data have not been available prior to 1996.

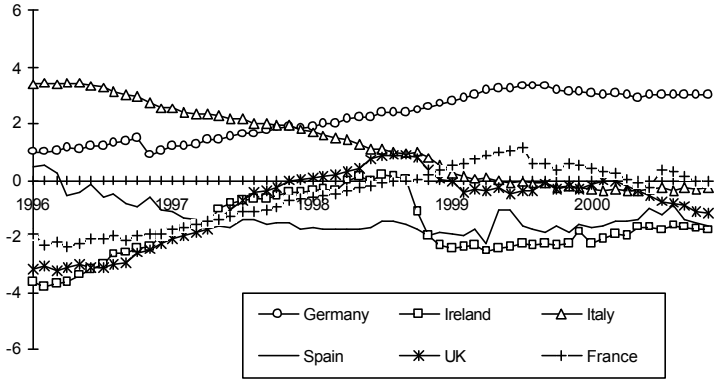
a) Money Market Rates



b) Deposit Rates



b) Lending Rates



Graph 2 — Differences in Lending Rates Across US Regions 1966-1998

The graphs give the difference between interest rates by census region and the US average. The data have kindly been provided by John C. Driscoll (see also Driscoll 2000), and have been calculated from the FDIC call reports by dividing income from loans by quantity of loans and are thus proxies for average interest rates on all outstanding loans. Only commercial banks are covered, and all types of loans (i.e. C&I loans, mortgages, and other kinds of loans) are included.