Consumer Credit Rates in the Eurozone

Evidence on the Emergence of a Single Retail Banking Market

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and
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CONSUMER CREDIT RATES IN THE EUROZONE: EVIDENCE ON THE EMERGENCE OF A SINGLE RETAIL BANKING MARKET

STEFANIE KLEIMEIER AND HARALD SANDER

EXECUTIVE SUMMARY

This study provides new evidence on the emergence of a single eurozone retail banking market with particular reference to consumer credit. Given the heterogeneous nature of consumer credit products in the eurozone, the authors reject the earlier proposition of the Cecchini study, which equates banking market integration with identical interest rates throughout the eurozone. The present study advocates the use of the co-integration methodology, which allows us to investigate integration in the presence of country-specific credit rates. The empirical results indicate only very limited evidence of an integrated retail banking market prior to 1 January 1999, pointing to the limited effectiveness of the single market cum Second Banking Directive in particular in integrating consumer credit markets.

The relationship of national lending markets with the remaining eurozone lending markets, however, exhibits strong signs of structural changes that have come along with the introduction of the single currency. Regarding this period under monetary union, the results provide a first picture of an emerging uniform eurozone banking market. This tendency is more pronounced for the corporate lending market, while consumer lending markets are still more fragmented. The study identifies three possible driving forces of this integration process: cross-border borrowing and lending (arbitrage), a competitive national and international retail banking environment, and a smooth and uniform pass-through of interest rate changes onto lending rates. While the extent of cross-border retail banking is still very limited and interest rate pass-through is working most efficiently and uniformly in the more competitive corporate lending market, the authors conclude that the single currency has the potential to "complete" the single market in a very special sense. It is not so much cross-border arbitrage that has so far produced the "statistical signs" of an uniform retail banking market, but a smooth and uniform pass-through of interest rate changes induced by the single monetary policy. The lack of evidence of integration in consumer credit so far therefore also points to the relevance of competition policy for creating a uniform consumer credit market in the eurozone.

CHAPTER I

INTRODUCTION

In 1988, the Commission of the European Communities commissioned a study, now widely known as the Cecchini report (European Commission, 1988), which derived quantitative estimates of the benefits of financial market integration. The study predicted that post-integration prices will fall to a level equal to the prices of the country with the lowest pre-integration prices. In order to realise these predicted benefits, the Second Banking Directive (2nd BD) was implemented on 1 January 1993, for the member countries of the European Union with the intent to provide an appropriate regulatory environment for the single European banking market. As Kleimeier and Sander (2000) have shown, however, the degree of integration in the retail banking market before the introduction of the single currency on 1 January 1999 was limited. This situation raises the question of the extent to which the single currency will contribute to the creation of a single consumer credit market. For example, Tommaso Padoa-Schioppa (2000) from the ECB board argues that the "multiplicity of currencies in the single market was a fundamental factor behind the preservation of the segmentation of the banking industry" and that "it is indeed the existence of a single currency and a single central bank which very often unifies a banking system". Nonetheless, while most observers find at least some evidence for the emergence of a single banking industry in the area of wholesale banking and capital market activities, they remain more sceptical in the area of retail banking and, in particular with respect to consumer credit (Padoa-Schioppa, 2000 and Diez Guardia, 2000).

The aim of our study is to provide further evidence on the emergence of a single eurozone retail banking market with particular reference to consumer credit. To do so, we develop a methodology that allows us to shed light on the following questions in the debate on convergence of consumer credit rates in the eurozone:

- How effective have the single-market cum Second Banking Directive undertaking been so far in integrating consumer credit markets?
- Are *nominal* and *real* costs of borrowing converging across Europe?
- Is there evidence of differential effects in various consumer credit products?
- How effective is the transmission of interest rate changes by monetary policy into lending rates and are there differences in the "pass-through" among the countries of the eurozone and among the various lending rates?
- What has been the contribution of the single currency so far and what is its likely future impact on this process?

Any attempt to answer these questions today is highly ambitious for the very simple reason that the data available are very limited. And to draw conclusions either from past data after almost revolutionary changes have taken place in the European monetary system, or from a two-year experience with a single currency and all the transition processes underway is risky, to say the least. We therefore fully bear in mind the limitations of the analysis resulting from the limitations of the database. Nonetheless, we hope to develop an approach that allows us to answer these research questions in principle – and in particular and with increasing confidence when the integration process further unfolds.

CHAPTER II

TOWARDS AN INTEGRATED EUROPEAN RETAIL BANKING MARKET?

1. Recent developments in European banking

Bank lending plays a dominant role in providing funds to the corporate, private and public sector in Europe. Based on data for 1999 provided by the European Central Bank (2000a), bank loans in the eurozone amounted to 100.4% of the gross domestic product which is clearly higher than, for example, the corresponding figure (48.4%) in the United States. In contrast, market-based forms of funding, which are an alternative for corporations, are used to a lesser extent in the eurozone. Outstanding domestic debt securities amount to 88.8% in the eurozone, compared to 164.6% in the US, and stock market capitalisation amounts to 71.1% in the eurozone, compared to 163.3% in the US.

The banking market in the EU has been shaped to a large extent by the regulatory process aiming at liberalisation and integration. At the beginning of the 1980s, the banking markets of Italy, France and Belgium could be considered to be highly regulated, whereas banking markets in Germany, the United Kingdom and the Netherlands were only slightly regulated (De Bondt, 1998). For example, capital controls were in place in many highly regulated countries. Furthermore, interest rate regulations were in place as late as 1992 or 1993 in some EU member countries (Diez Guardia, 2000). Specifically, interest rates were deregulated early in the UK (1979), Germany (1981) and the Netherlands (1981) compared to Denmark (1988); Belgium, France, Italy, and Luxembourg (all 1990); Spain and Portugal (both 1992) and Ireland and Greece (both 1993). Even if the establishment of the common market has been an objective in the EU since the 1957 Treaty of Rome and has been reinforced by the 1985 White Paper and the 1986 Single European Act, very little had been achieved for the banking markets until the 2nd BD of 1989. Regarding key regulatory elements, the First Banking Directive (1st BD) of 1977, which allowed for cross-border branching under the host-country rule,[1] was not very effective in reducing differences between national regulatory systems and was thus followed by a 2nd BD. The latter relied on three fundamental principles: harmonisation, mutual recognition and home country control and supervision[2] – the latter representing a complete turnaround in regulatory policy compared to the 1st BD.

Since 1986, additional directives which are aimed at further harmonisation of the different national EU banking markets have been passed concerning bank supervision, capital adequacy, solvency standards, money laundering, consumer credit or publishing and consolidation of annual accounts to name but a few.[3] In the area of consumer credit,

[1] Under the host-country rule, a bank had to obtain permission to operate in a foreign country by the supervisory agencies of that country.

[2] Harmonisation should lead to a system where banks operating in several countries face a common set of EU regulations. Mutual recognition implies that the banking charter of the home country is sufficient to operate in all EU countries. Home-country rule, finally, stipulates that foreign-owned banks are regulated by their home country and not by the host country.

[3] For details see Kleimeier (2001), Sander and Kleimeier (2000), Diez Guardia (2000) and Zimmerman (1995).

in 1986 the European Community introduced a consumer credit directive. The main two objectives of this directive were consumer protection and facilitation of cross-border credit by means of harmonisation of the banks' information provision to its customers. This directive was amended and completed by two more consumer credit directives in 1990 and 1998, respectively.[4]

On 1 January 1999, the euro replaced the national currencies of Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain. Of the remaining EU countries, Greece initially failed to meet the required economic criteria but joined EMU on 1 January 2001, whereas Denmark, Sweden and the United Kingdom have elected not to join the EMU as yet.

Assessing the eurozone banking markets from a purely legal perspective, integration can be considered as far advanced (Zimmerman, 1995 and Bredemeier, 1995). However, non-regulatory barriers to integration, such as cultural differences in consumer behaviour and preferences for certain types of credit, continue to exist. Thus according to the ECB, whereas eurozone interbank and wholesale markets are considered to be integrated, the extent of integration in the retail banking markets appears to be limited. For one thing, retail lending products are less exposed to international competitive pressure since proximity to customers is important even when one accounts for advances in modern distribution technology. On the other hand, this impression is re-enforced when looking at the limited extent of cross-border lending. The focus in bank lending and deposit-taking is clearly domestic. In 1999, 79.8% of all loans and 72.8% of loans to the non-bank private sector were domestic. Similarly, 72.8% of all deposits and 86.5% of deposits to the non-bank private sector were domestic. Moreover, 66.7% of all government securities and 39.5% of all non-bank private securities are domestic. Only for this last business activity is the foreign business dominant and euro-area holdings amount to 19.1%.

Nevertheless, the growth rates for all eurozone activities – with the exception of deposits from the non-bank private sector – are positive and larger than the corresponding growth rates for domestic activities. Furthermore, the market shares of foreign banks in Europe were still very low in most countries in 1997. In Denmark, France, Italy, the Netherlands, Austria, Finland, Portugal and Spain, foreign banks have a market share of less than 12%. In Belgium and Ireland, their market shares lie in the mid-range with 36.3% and 53.6%, respectively. Only in Luxembourg do foreign banks dominate the market with a share of 99.9% (ECB, 1999a, 1999b, 2000a and 2000b). Similar figures have been reported by Diez Guardia (2000).

One reason for these localised retail banking markets where banks are neither reaching out for all prospective eurozone customers, nor are consumers shopping around for credits in the whole eurozone is given by Padoa-Schioppa (2000). He refers to a survey conducted by the US Federal Reserve Bank that found that 90% of a bank's clientele in the United States is located on average within a distance of less than 20 miles of the bank's premises. He concludes that "proximity is an intrinsic characteristic of the retail market with or without the emergence of a currency embracing a wider area". One

[4] For details and evaluation, see Diez Guardia (2000).

should read such results with caution, however, as the localisation of retail banking in the US is also, and in particular, the result of US banking regulation.[5]

Another reason for the low incidence of cross-border lending could lie in the organisational strategies adopted by European banks with respect to the type of bank they want to become in an integrated European banking market. In principle, a bank can either become a Europe-wide universal bank, a domestic universal bank, a Europe-wide specialised bank or a domestic specialised bank. According to Marois (1997), the strategies adopted by European banks are diverse and a dominant strategy has yet to emerge. The deregulatory process in the EU has however sparked two phases of bank mergers and acquisitions (M&As) in Europe. The first phase took place in the late 1980s and early 1990s as a reaction to the 2nd BD and the second phase took place in the second half of the 1990s in anticipation of EMU (Tourani Rad and van Beek, 1999). As Padoa-Schioppa (2000) argues, it is an error to believe that "a single banking industry will only emerge when cross-border mergers occur". Nevertheless, the pattern of M&As can give us an indication about the types of banks operating in the European market.

Table 1. Value of M&As in the financial sector between 1985 and 1997

	Acquirer					
	Commercial bank		Securities firm		Insurance company	
Target	Value	% of total	Value	% of total	Value	% of total
Panel A. Domestic M&As						
Commercial bank	89.0	36.0	23.0	9.3	11.0	4.4
Securities firm	9.0	3.6	19.0	7.7	6.0	2.4
Insurance company	20.0	8.1	24.0	9.7	46.0	18.6
Panel B. Intra-European M&As						
Commercial bank	15.0	17.9	4.3	5.1	11.2	13.4
Securities firm	8.7	10.4	5.8	6.9	0.3	0.4
Insurance company	0.4	0.5	1.1	1.3	37.0	44.2
Panel C. Europe-Non-Europe M&As						
Commercial bank	14.5	14.5	15.6	15.6	1.0	1.0
Securities firm	4.3	4.3	15.9	15.9	3.1	3.1
Insurance company	0.3	0.3	12.9	12.9	32.7	32.7

Note: Values are given in billions of $. For each panel, the percent figures total 100.

Source: Berger, Demsetz and Strahan (1999).

Note in Table 1 that the total value of domestic M&As, which is mainly driven by acquisitions of commercial banks and securities firms, exceeds that of cross-border M&As. Only for insurance companies does the value of cross-border M&As exceed the value of domestic M&As. This implies that consolidation is still taking place on a national rather than international level. Furthermore, for commercial banks and securities firms, M&As within Europe are as important as other foreign M&As,

[5] The McFadden Act, which was in place from 1927 until 1994, explicitly prohibited interstate branching. In 1994, the basis for a truly US-wide banking system was laid with the adoption of the Riegel-Neal Interstate Banking and Branching Efficiency Act.

indicating a global rather than regional consolidation process. Consolidation within the sector is also more common than consolidation across sectors with domestic M&As and to a lesser extent Europe-non-Europe M&As, with the only exception being when the acquirer is a securities firm. This would indicate that most banks in Europe are still specialised rather than being universal banks. Taken together these findings show that the typical EU bank can still be characterised as a specialised domestic bank. Therefore, the result presented earlier that most bank activities are still domestic in nature is not surprising (Kleimeier, 2001).[6]

2. What constitutes an integrated banking market?

2.1 The non-applicability of the "law of one price" in credit markets

Quantifying the degree of integration of the retail banking market is not an easy task. The Cecchini study advances the hypothesis of price equalisation for financial assets within Europe as *the* characteristic of completely integrated markets. This "law of one price" manifests itself in financial markets as the "interest rate parity". It is well established that under perfect capital mobility the covered interest parity typically holds, but it is more difficult to establish the empirical validity of the uncovered interest parity (UIP) due to exchange rate volatility or exchange rate expectations.

In the context of retail banking, the case for the law of one price is, however, not so straightforward. First, the interest rate parity is suggested as parity for interest rates on assets such as government bonds, which are close if not perfect substitutes. This is clearly not the case for bank assets such as consumer credits. Rather, credits are characterised by heterogeneity caused by risk differences, cultural influences in bank-client relationship, country-specific strategic bank behaviour in order to cope with informational imperfections (moral hazard, incentive effects, etc.), to name just a few. Consequently, one cannot expect the law of one price to hold in the strict sense in the consumer credit market. Secondly, there is clearly not (yet) a perfect "capital" mobility. As discussed in the previous section, banks are neither reaching out to all prospective eurozone customers, nor are consumers shopping around for credits in the whole eurozone, i.e. retail banking is still localised. Thus, retail interest rates may not as easily equalise as suggested by the Cecchini study. Rather, even when they are equalising but the underlying characteristics of credits are different, this may not even be a sign of an integrated banking market. Looking simply at interest rate convergence or equalisation can therefore be profoundly misleading.

2.2 Interest rate trends in the eurozone – Some descriptive statistics

Despite the reservation we have about the use of descriptive statistics, we report them in Table A1 in the Annex and illustrate the (non-) convergence process in Figures 1 to 3 below. The data source is the ECB's National Retail Interest Rates Statistics. We report the following interest rates: mortgage loans to households (N2), consumer loans to

[6] It is interesting to note that the only strategy that can be characterised as clearly European is the acquisition strategy that insurance company follow within Europe when acquiring banks. This strategy accounts for 13.4% of all intra-European M&As and is the only M&A type for which the intra-European percentage is higher than either the domestic or the non-European share. Thus, it appears that a European trend towards ALLFINANZ might be emerging.

households (N3), and to compare the developments for households with those for the corporate sector we also report the lending rate charged to the corporate sector (N4). These rates are available on a monthly basis starting in the 1980s with most countries reporting regularly as of 1989. We will, however, concentrate on the period from April 1995 to December 2000, since data for all countries are available for this time on a regular base (a more detailed description of the data is provided in Box 1). We also distinguish a pre-euro period characterised by the process of implementing the single market up to the end of 1998 and a second period that is characterised by the introduction of the single currency after 1 January 1999.

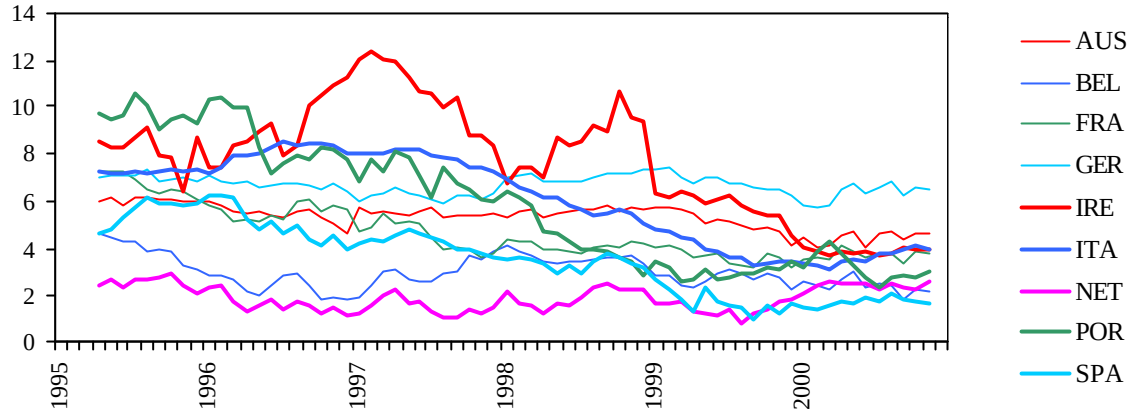
Figures 1 and 2 show the convergence of interest rates for mortgage rates, consumer lending rates and corporate lending rates in both nominal and real terms. Clearly all nominal rates are now closer together then they were in the mid-1990s, but this can largely be attributed to the effect of macroeconomic factors, in particular the single monetary policy. It is also clear that mortgage rates are closer together because the credit characteristics across countries are more similar throughout the eurozone as compared to the lending rates charged for the other credit forms that differ more widely in their characteristics (as well as in their statistical definition). For example, while Italy had the highest average mortgage rate of 11.1% in the pre-EMU phase and Belgium with 6.1% the lowest rate, both countries have the almost identical average rate of about 6% in the EMU phase. As argued before, however, interest rates need not be equalised – and in most cases should not be equalised, even in the presence of an integrated banking market.

From the “localised” consumer's point of view, however, the real, consumer price inflation-corrected cost of mortgage borrowing still differs widely throughout the eurozone, with the highest real cost in France (5.2%) and the lowest in Ireland (1.4%), mainly because of differences in consumer price inflation. As far as consumer and corporate lending rates are concerned, also here the cross-country differences have become smaller, but they still remain large, in particular for consumer lending rates.

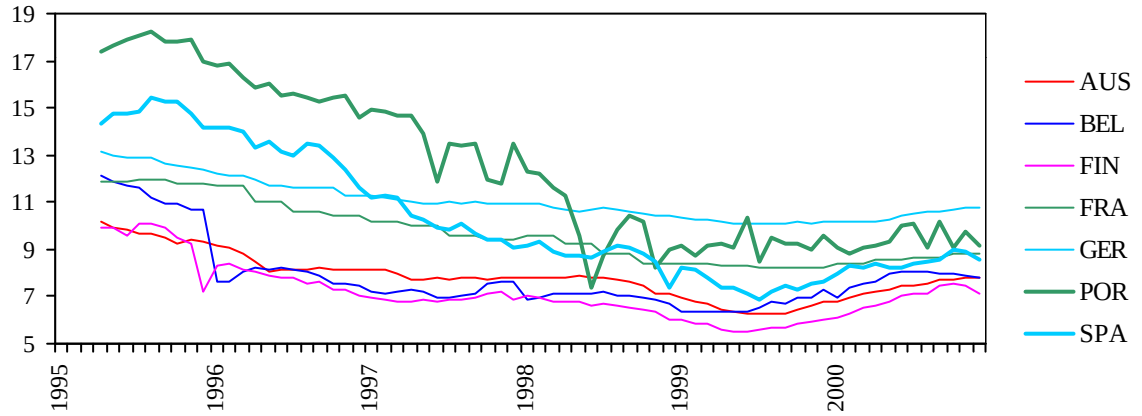
In Figure 3 we show the development of the spread between retail lending rates and the money market rate (as a proxy of the banks’ cost of funding), which could be interpreted as a rough proxy for credit market imperfections. A recent study by Corvoisier and Gropp (2001) has shown that despite the pro-competitive move in European banking through deregulation, the increased concentration stemming from the recent wave of bank mergers may have resulted in less competitive loan pricing by banks. Our figure is consistent with this assessment and additionally shows that spreads differ significantly across countries but also across lending markets with spreads for consumer lending typically being the highest. Moreover, as far as convergence patterns are concerned, the only clear effect can be found in the mortgage market.

Figure 1. Nominal interest rates

Panel A. Mortgage lending rates



Panel B. Consumer lending rates



Panel C. Corporate lending rates

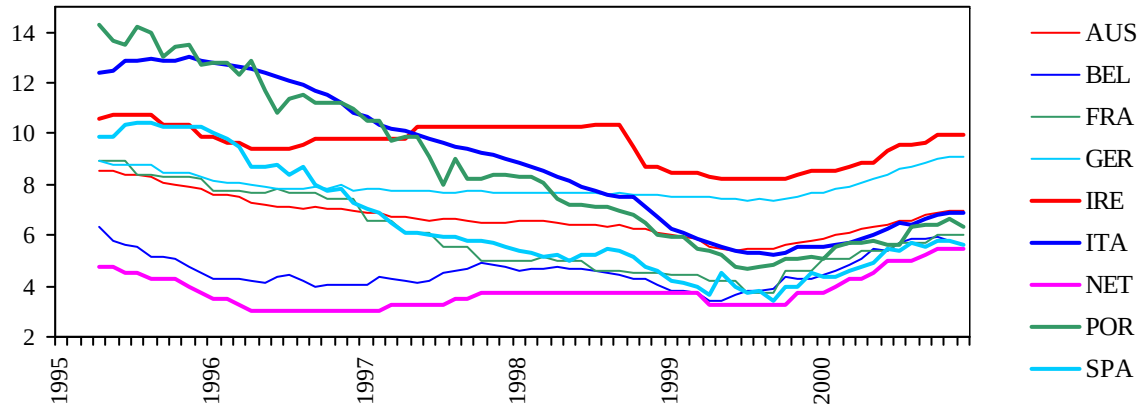
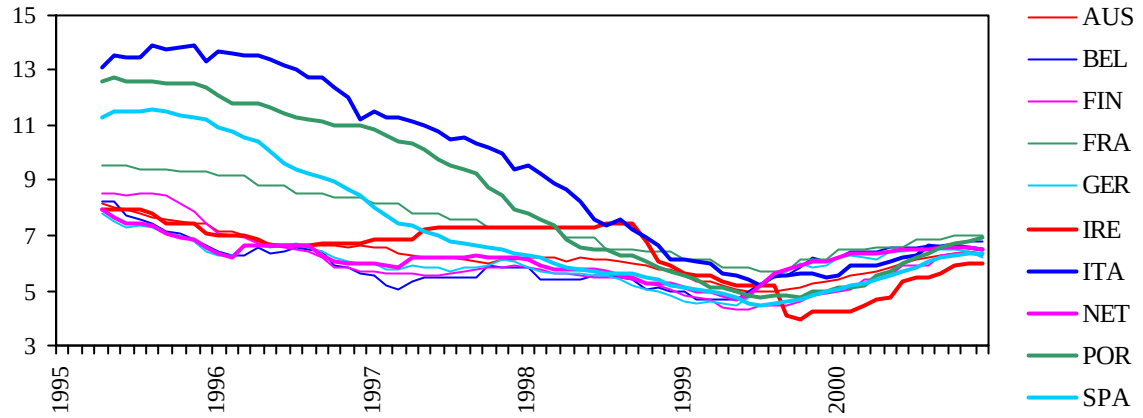
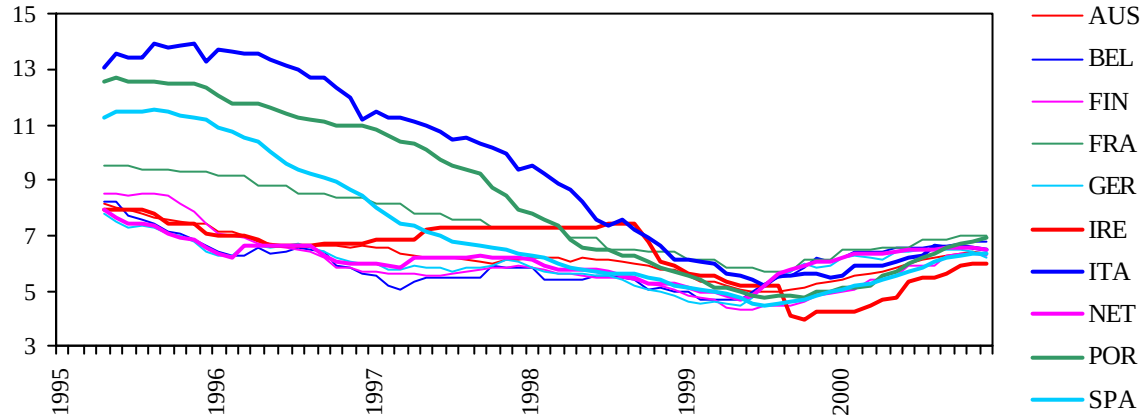


Figure 2. Real interest rates

Panel A. Mortgage lending rates



Panel B. Consumer lending rates



Panel C. Corporate lending rates

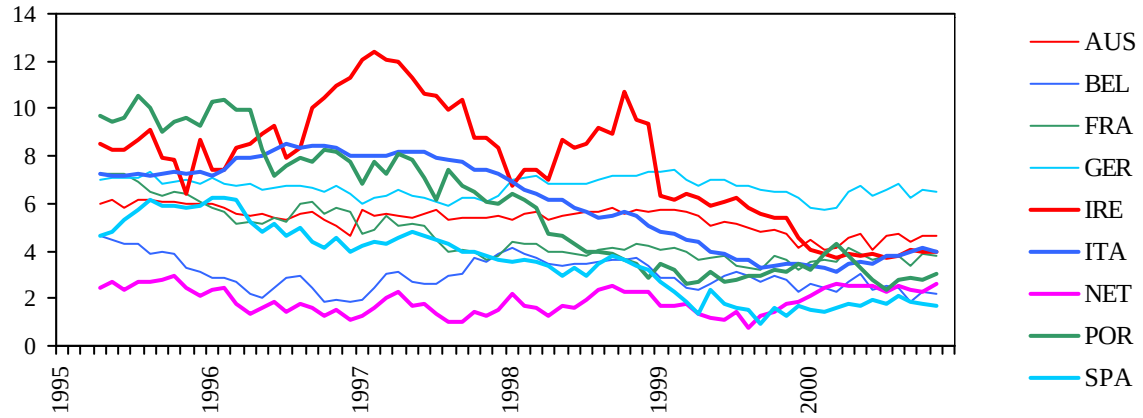
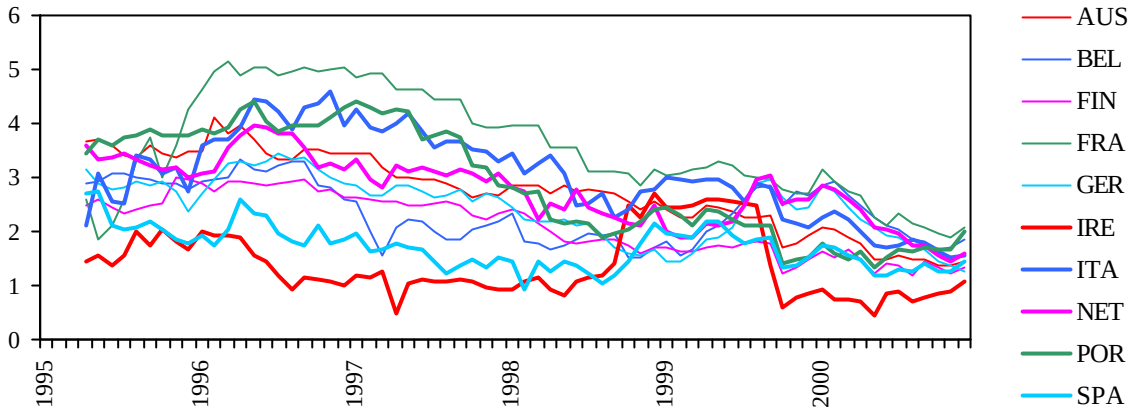
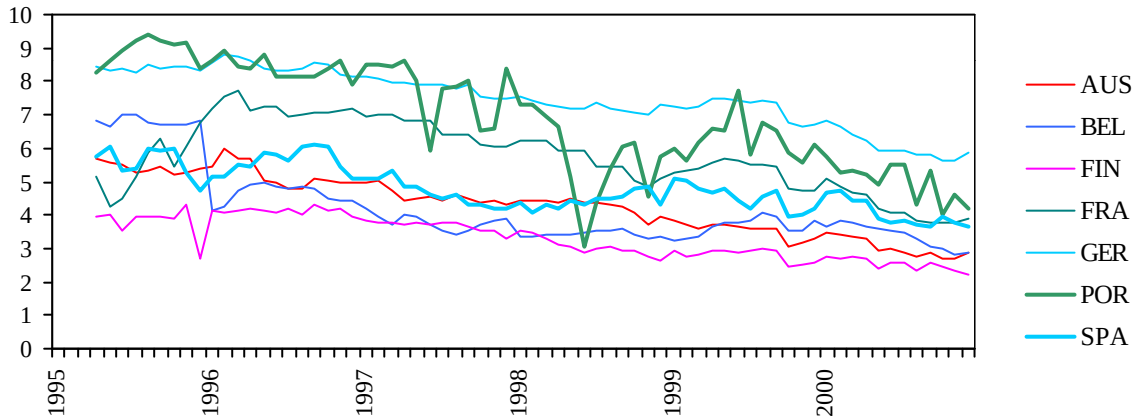


Figure 3. Interest rate spreads

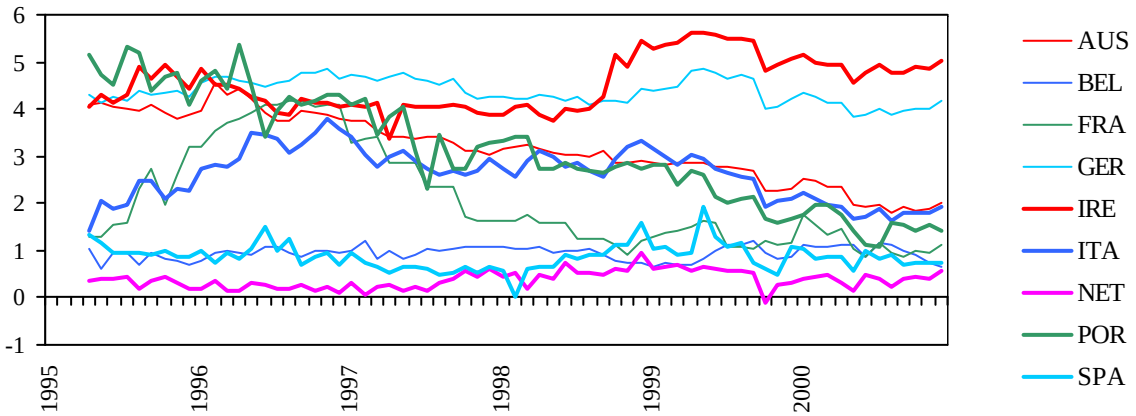
Panel A. Mortgage lending rates



Panel B. Consumer lending rates



Panel C. Corporate lending rates



Box 1. Data sources and data construction

Our study mainly relies on monthly national retail interest rates that have been obtained from the European Central Bank. The ECB collects three consumer lending rates: overdrafts on cash accounts (series N1), mortgage loans to households (series N2) and consumer loans to households (series N3). As the series N1 is only available for France and Ireland, we are forced to focus on the remaining series N2 and N3. In addition, we report results for corporate lending rates based on the series N4 short-term loans to enterprises. These series are available for the EMU member countries of Austria, Belgium, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal and Spain. Greece has not been included in our study as it did not join EMU until January 2001. Note, however, that for Finland no data are available for N4. For France, N2 and N3 are only available as quarterly data. When analysing French lending rates, we assume that interest rates are constant during the given quarter and thus convert the quarterly to a monthly frequency by filling in the missing values. For Belgium, Italy and Portugal several different N4 series are available and the series 4.1, 4.1 and 4.2 have been chosen, respectively, as the relevant corporate lending rate. Finally, whereas some national series start as early as 1980, data for all EMU member countries are available only as of April 1995. Thus we decided to focus on the period from April 1995 until December 2000. For details on data, see the ECB's National Retail Interest Rates – Methodological Notes.

Based on these nominal interest rate series, real interest rates are calculated by deducting inflation rates. Inflation rates are calculated as the percentage change in the consumer price index (CPI) which is obtained from the CD-ROM version of the IMF's International Financial Statistics (IFS). From January 1996 until December 2000, a harmonised consumer price index (HCPI) as given in the IFS's line 64H is available for all EU countries and has been used. Before January 1996, the national CPI of line 64 is used. Exceptions to this rule are the following: For Portugal, national CPI data are used until December 1998 and HCPI is used starting January 1999. For Ireland, no CPI data are available. Thus, inflation rates are calculated based on wholesale prices until December 1998, and HCPI is used starting January 1999.

In order to calculate European weighted averages for the nominal and real interest rate series N2, N3 and N4, weights for each country have to be found. These weights should appropriately reflect the relative economic importance of the eurozone countries. We therefore work with the OECD (2000) weighting scheme for aggregate measures, which is based on 1995 GDP and purchasing power parities. The weights are 0.82 for Austria, 1.05 for Belgium, 0.46 for Finland, 5.72 for France, 8.33 for Germany, 0.31 for Ireland, 5.49 for Italy, 1.57 for the Netherlands, 0.65 for Portugal and 2.84 for Spain. Note that when estimating equation (1.3), the country under investigation is excluded from the European average and the weights are re-scaled to sum up to 100%.

Finally, money market rates are obtained from line 60b of the CD-ROM version of the IMF's IFS. National rates are used until December 1998, but due to the convergence of money market rates under the single currency, euro area rates have been used as of January 1999.

2.3 Co-integrated retail banking markets

Because of the different characteristics of the various (still) national credit instruments (as well as the differences in the reported statistics), we propose to base the judgement about the existence of a uniform eurozone retail banking system on the existence of "co-integration" among national credit markets in Europe. This concept realises that although full equalisation cannot be expected, the concept of market integration requires

that interest rates should exhibit a certain long-run equilibrium relationship. Thus, we do not require that the national interest rate of a country (L_{nat}) should equal the interest rate in the remaining eurozone (L_{EU}) as it would be required by the "law of one price" shown in equation (1):

$$(1) \qquad L_{nat} = L_{EU}$$

Rather, we accept as a possible long-run relationship that the rates may differ from each other such that:

$$(2) \qquad L_{nat} = a + b\, L_{EU}$$

In the long-run, equation (2) can be interpreted as a relationship reflecting the existence of a financial system with "structural trends and systematic disturbances in banking [that] cut across state borders",[7] while deviations from the long-run equilibrium relationship are possible in the short-run. This equation could in principle be estimated by means of regression analysis. However, since interest rates typically follow a so-called "random-walk", also known as an "integrated time series", one may obtain spurious results from regression analysis. To establish that there exists a certain long-term relationship one therefore has to undertake a so-called *co-integration analysis* (for details, see Box 2). If co-integration is found, this reflects that national interest rates are connected in terms of a long-term relationship as shown in equation (2). This retail interest rate link must, however, not necessarily reflect banking market integration in the sense suggested by Cecchini. Rather, in the short-run, deviations from this long-run equilibrium can be corrected over time by one or more of the following three mechanisms:

- An international arbitrage (cross-border lending) process where banks increasingly shift their lending activities to countries where lending rates are the highest while consumers borrow in low-interest countries.
- When money market rates equalise by means of an international arbitrage process, such changes will have an impact on lending rates via domestic competition that ties lending and borrowing rates together (interest rate pass-through).
- Increased (international) competition, or the threat of it as suggested by the theory of contestable markets will help to harmonise the pricing behaviour of banks and thus lead to a harmonisation of retail prices.

In the remainder of the study, we will investigate the presence or absence of such a long-term relationship among eurozone retail banking markets and enquire into the mechanisms that eventually bind national interest rates together.

[7] For this sentence we have used the words of Padoa-Schioppa (2000) which he used to refer to the localised US financial system, which is widely viewed as integrated.

Box 2. Co-integration methodology

To establish that there exists a certain long-term relationship between national interest rates and the weighted average of the remaining eurozone countries, such as the one indicated in equation 2 in the main text, we have to undertake *co-integration testing.* Following Engle and Granger (1987), a setting where time series of individual variables "can wander extensively and yet some pairs of series may be expected to move so they do not drift too far apart" is best being studied in the context of a co-integration analysis. The reason for the need of using this methodology is that simple regression analyses of equations like (2) may lead to spurious results when time series such as interest rates follow a so-called random walk. The underlying idea of co-integration is that such non-stationary time series, however, can move apart in the short-run, but will be brought back by market forces to an equilibrium relation in the long run. The co-integration methodology applied in this study follows closely the approach promoted by Engle and Granger (1987) and proceeds in three steps. First the time series must be proven to be unit roots. Only then can the co-integration vector be estimated. Finally, once co-integration has been established, the corresponding error correction model will be estimated.

In order to establish whether the interest rates are unit roots, or I(1), two test statistics, a t-statistic and an F-statistic, will be employed based on regressions on levels as well as first differences of the underlying series. Both include next to lagged observations of the lending rate L in question also a trend variable T:

$$(2.1) \quad \Delta L_t = \eta_0 + \eta_1 L_{t-1} + \eta_2 \Delta L_{t-1} + \eta_3 T + \varepsilon_t$$

$$(2.2) \quad \Delta^2 L_t = \eta_0 + \eta_1 \Delta L_{t-1} + \eta_2 \Delta^2 L_{t-1} + \eta_3 T + \varepsilon_t$$

The null hypothesis states that the series follow random walks. For the t-statistic, this corresponds to a null hypothesis of H_0: $\eta_1 = 0$ and for the F-statistic to a null hypothesis of H_0: $\eta_1 = \eta_3 = 0$. We fail to reject the null hypothesis of a random walk if the calculated t or F values are smaller in absolute terms than the critical values. Thus, as a precondition for co-integration, we have to accept the null hypotheses for equation (2.1.) but reject them for equation (2.2).

Once the I(1) characteristic has been established, co-integration testing can commence starting with estimating the co-integration regression using the national lending rate L_{nat} for the individual country as the dependent variable and the weighted average rate for the remaining EU countries L_{EU} as the independent variable:

$$(2.3) \quad L_{nat,t} = a + b L_{EU,t} + u_t$$

A first co-integration testing procedure relies on the Durbin-Watson statistics (DW). The null hypothesis of no co-integration can be rejected when the calculated DW values resulting from the regression of equation (2.3) are larger than the critical values. As Engle and Granger point out, the Durbin-Watson test can be used as a good but only approximate indicator for co-integration and should be followed by a more specific testing procedure such as the Dickey-Fuller (DF) and augmented Dickey-Fuller (ADF) tests. The Dickey-Fuller test is based on the residuals of the co-integration regression

$$(2.4) \quad \Delta \hat{u}_t = -\delta_0 \hat{u}_{t-1} + \varepsilon_t$$

where the t-statistic for the estimated coefficient $-\delta_0$ provides an indication regarding the co-integration of the two series. In particular, the null hypothesis of no co-integration can be rejected when the t-statistic is larger in absolute value than the critical value.

The augmented Dickey-Fuller test is obtained in a two-step procedure from the regression

$$(2.5) \qquad \Delta\hat{u}_t = -\delta_0 \hat{u}_{t-1} + \sum_{i=1}^{4} \delta_i \Delta\hat{u}_{t-i} + \varepsilon_t$$

In the first step, equation (2.5) is estimated including all 4 lags of $\Delta\hat{u}_{t-i}$. In the second step, equation (2.5) is re-estimated including only the significant lags of $\Delta\hat{u}_{t-i}$ from step 1. Now, the null hypothesis of no co-integration can be rejected when the t-statistic for the estimated coefficient $-\delta_0$ is larger in absolute value than the critical value.

Once the existence of a long-run relationship, i.e. co-integration is established, one can investigate the short-run dynamics of interest rates by estimating the corresponding error correction model (ECM). This model will provide an estimate of the speed of adjustment with which the system returns back to the long-run equilibrium. To find the correct specification of the ECM, first, an unrestricted vector autoregression (UVAR) is estimated based on the regression

$$(2.6) \qquad \Delta L_{nat,t} = \lambda_0 + \lambda_1 L_{nat,t-1} + \lambda_2 L_{EU,t-1} + \sum_{i=1}^{4} \lambda_{nati} \Delta L_{nat,t-i} + \sum_{i=1}^{4} \lambda_{EUi} \Delta L_{EU,t-i} + \varepsilon_t$$

From this regression, the significant lagged first differences of the exogenous and endogenous variables are identified and included in the final ECM in combination with any error correction terms ECT obtained from the estimated errors that were found significant in the co-integration

$$(2.7) \qquad \Delta L_{nat,t} = \varphi_0 + \varphi_1 \hat{u}_{t-1} + \sum_{i=1}^{4} \varphi_{nati} \Delta L_{nat,t-i} + \sum_{i=1}^{4} \varphi_{EUi} \Delta L_{EU,t-i} + \varepsilon_t$$

The estimated coefficient φ_1 of the ECT measures the speed of adjustment. For example an estimated φ_1 of -0.2 indicates that if there is a shock to the national lending rate $L_{nat,t}$, which raises its value relative to the equilibrium relationship to the co-integrated EU-wide lending rate $L_{EU,t}$, then one-fifth of the divergence is eliminated in the following period.

CHAPTER III

IS A UNIFIED EUROPEAN RETAIL BANKING MARKET EMERGING? NO, NO AND MAYBE!

In this chapter, we base our judgement of whether a uniform European banking system is actually emerging on the result of the proposed co-integration analysis that we performed for all retail lending rates for all eurozone countries in both nominal and real terms.[8] While we are confident that the methodology we propose is helpful in monitoring the progress towards an integrated European banking market, the existing database is still the major obstacle for making strict judgements at the present time. Its limitations are three-fold. First, there is no sufficiently harmonised data on consumer credit (Diez Guardia, 2000). This problem can and should be addressed in the future, but in the meantime the data provided by the ECB can be used as a first proxy. Secondly, the time period for which data for all countries are available simultaneously is very limited. And third, the introduction of the single currency has brought about structural changes that limit the available database further. In particular, we find that the introduction of the single currency in 1999 has sufficiently shaken up the structural relationship to allow for judgements on the current state of integration based on data relating to the EMU phase. This limits the database from which to derive judgements to a 2-year period, which limits the power of the statistical work. But there is basically nothing that can be done about it, except to include past data that may not reflect the current state of integration. Given the data limitations, the results of the study will have to be interpreted with caution, but are, nevertheless, in our view still very valuable.

Figures 4 and 5 visualise the results of the structural break test that we have conducted for the co-integration relationship for both nominal and real lending rates (for details on the methodology, see Box 3). Typically the peaks in the figures represent the presence/timing of the structural break, provided that the F-statistics value exceeds a certain critical value (such as 15). See e.g. Germany in early 1999 in nominal mortgages. The first striking result is that for nominal interest rates almost all long-run relationships show evidence in favour of a structural break around late 1998 – that is, around the date of the introduction of the single currency. This is particularly true for mortgage and corporate lending rates, whereas structural breaks for consumer lending rates appear to occur on average about a year earlier, which supports the view that a single currency will have a major impact on the unification of a banking system. For real interest rates, we generally find structural breaks predominately occur between 1996 and early 1998, with the notable exception of Austrian and Dutch mortgage and corporate lending rates. This may be interpreted as the result of the convergence process in terms of inflation rates that occurred in the mid-1990s.[9]

[8] As explained in Box 2, co-integration analysis requires that the time series are random walks – that is, that they are integrated of the order 1. As shown in Table A2 in the Annex, this pre-condition is generally fulfilled. For nominal and real lending rates, there is evidence for I(0) or I(2) for only 10% of the series.

[9] To illustrate this point, let us consider fully integrated real interest rates with the real interest rates in two countries both being 5% (and varying thereafter driven by the same structural trends). With an expected inflation rate of 2% in both countries, the nominal rate would be 7%. Now consider one country starting from an inflation rate expectation of 6%, which would imply a nominal interest rate of 11%. If inflation and subsequently inflation expectations would converge to 2%, the nominal interest rate in the high-inflation country would decrease and, consequently, nominal interest rates would not be co-integrated during the inflation convergence process.

Figure 4. Rolling Chow Tests for Cointegration of Nominal Interest Rates

Panel A. Mortgage lending rates

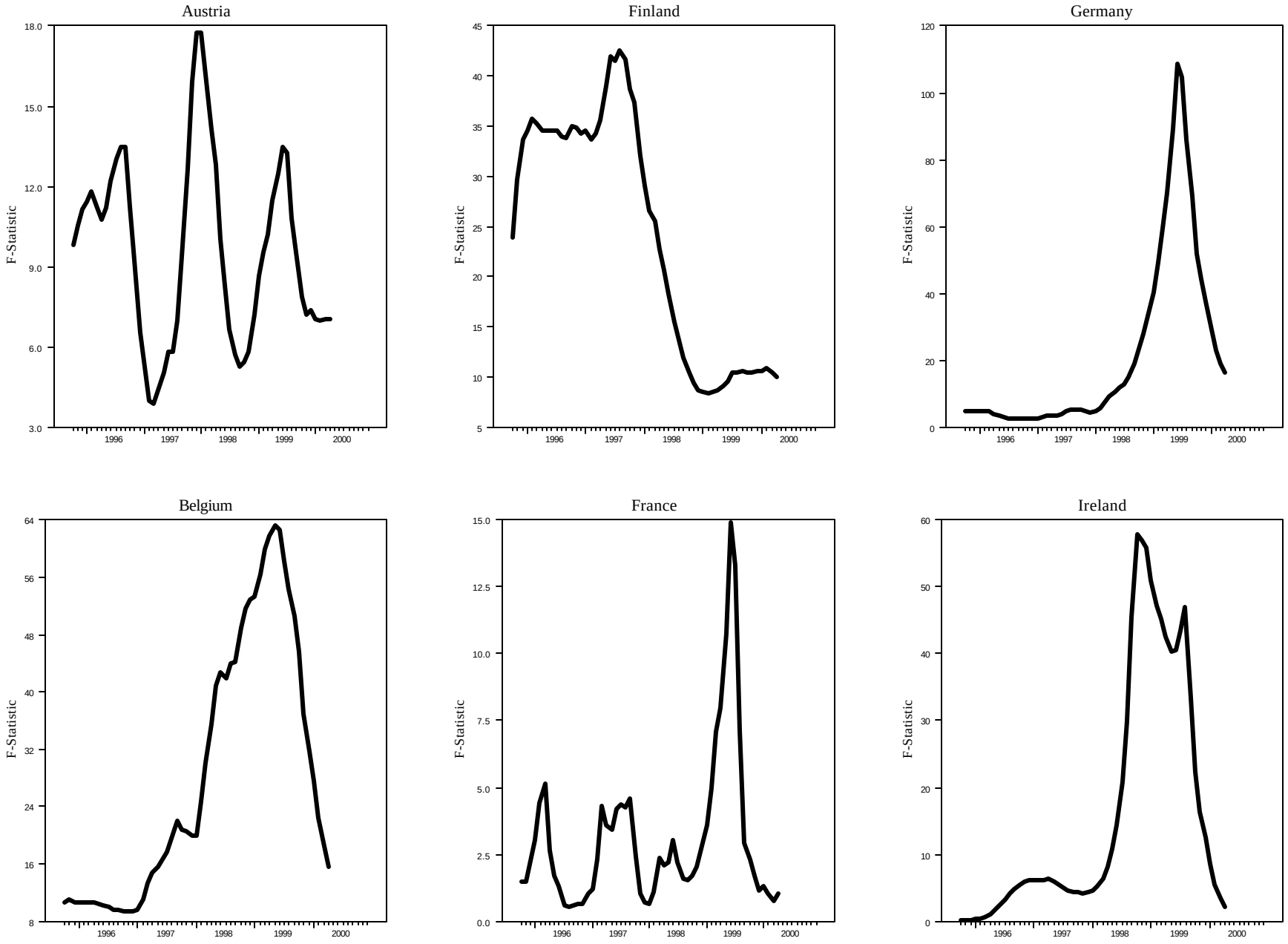
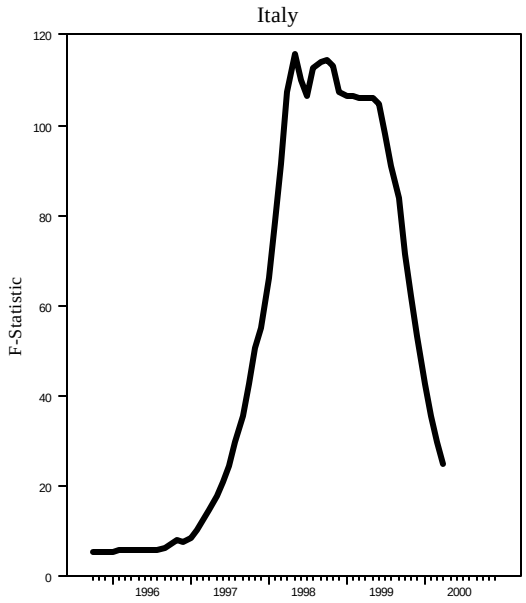
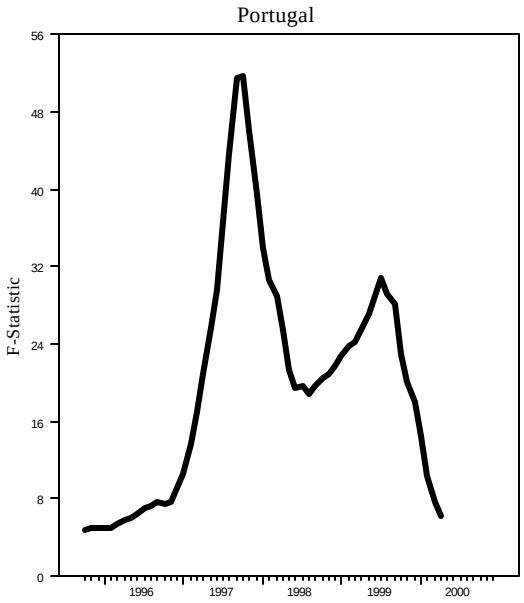
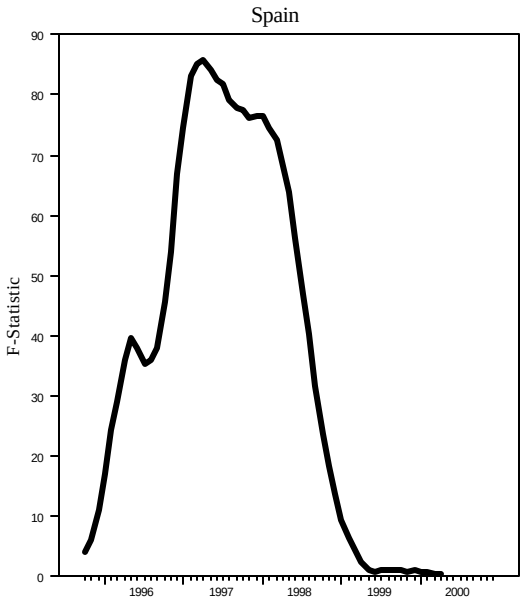


Figure 4 continued. Rolling Chow Tests for Cointegration of Nominal Interest Rates

Panel A, cont. Mortgage lending rates







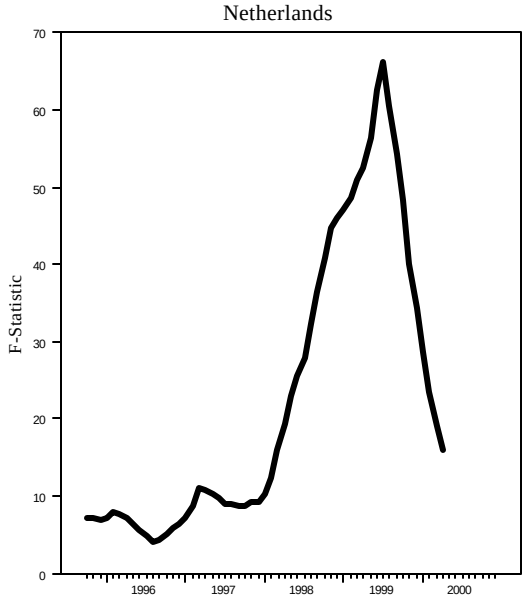


Figure 4 continued. Rolling Chow Tests for Cointegration of Nominal Lending Rates

Panel B. Consumer lending rates

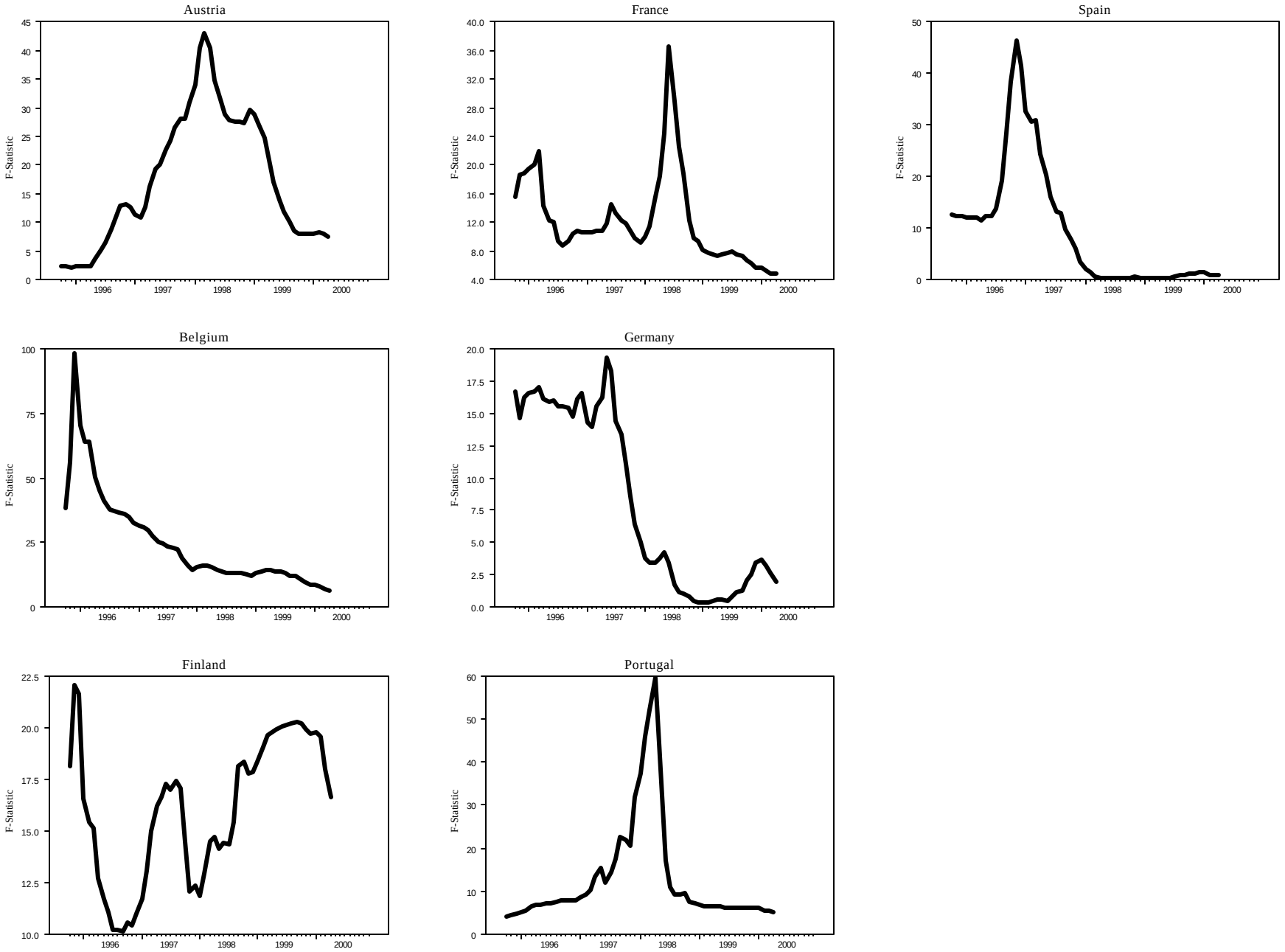


Figure 4, cont. Rolling Chow Tests for Cointegration of Nominal Lending Rates

Panel C. Corporate lending rates

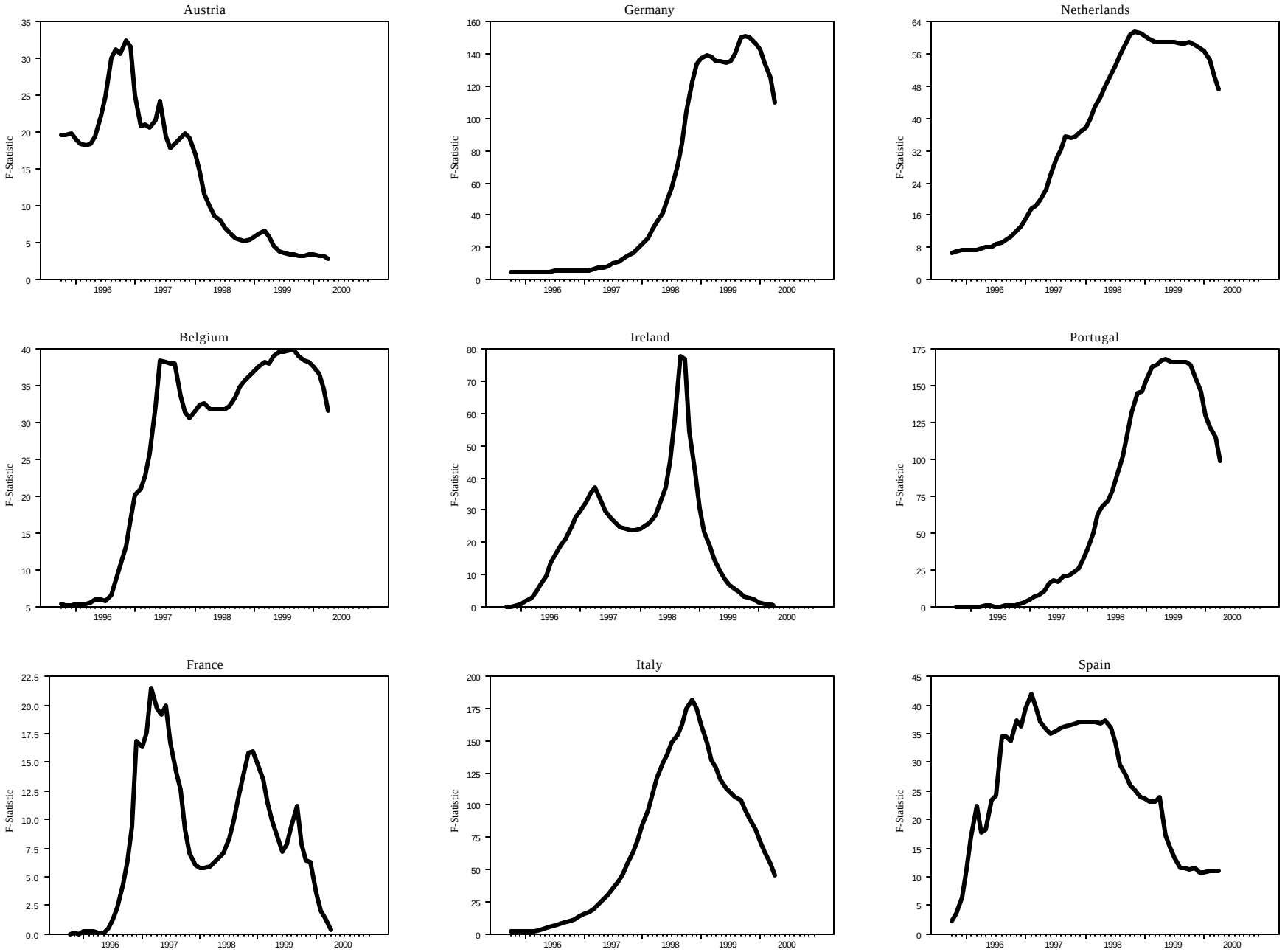


Figure 5. Rolling Chow Tests for Cointegration of Real Lending Rates

Panel A. Mortgage lending rates

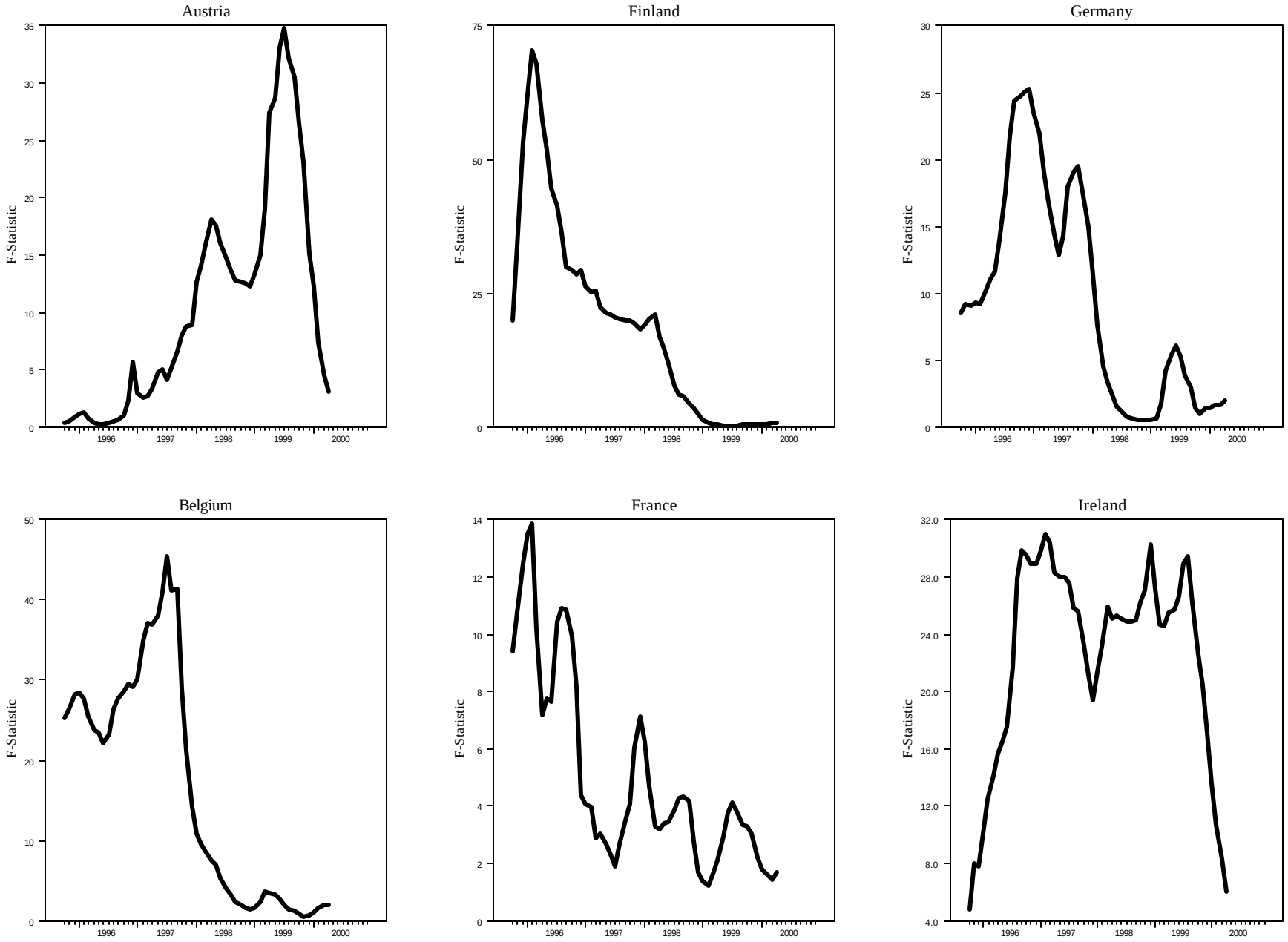
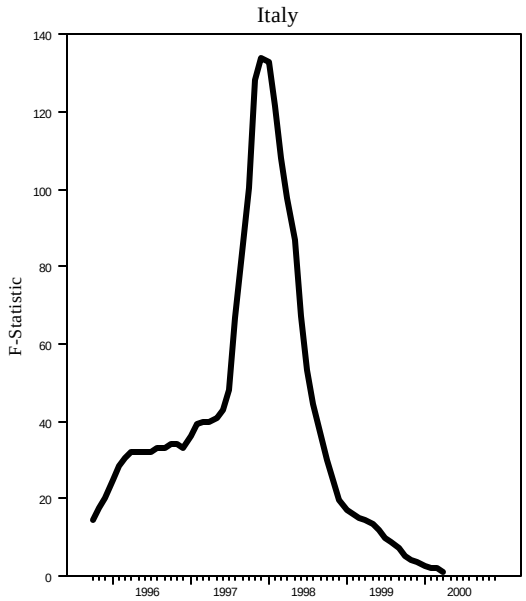
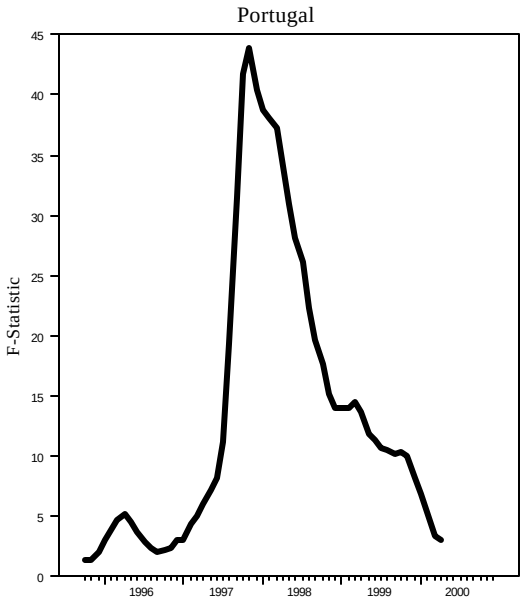
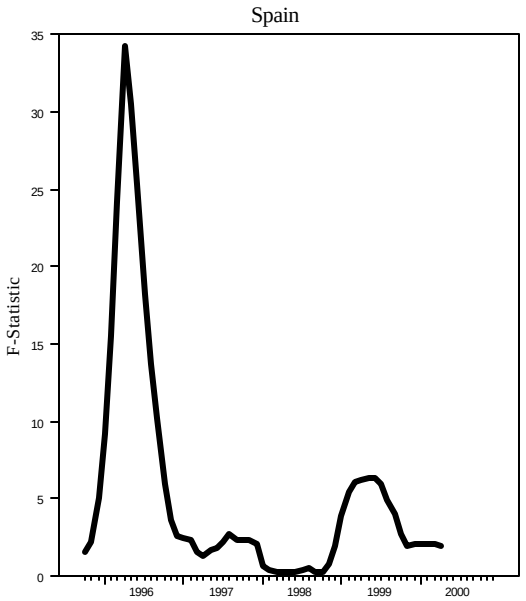


Figure 5, cont. Rolling Chow Tests for Cointegration of Real Lending Rates

Panel A, cont. Mortgage lending rates







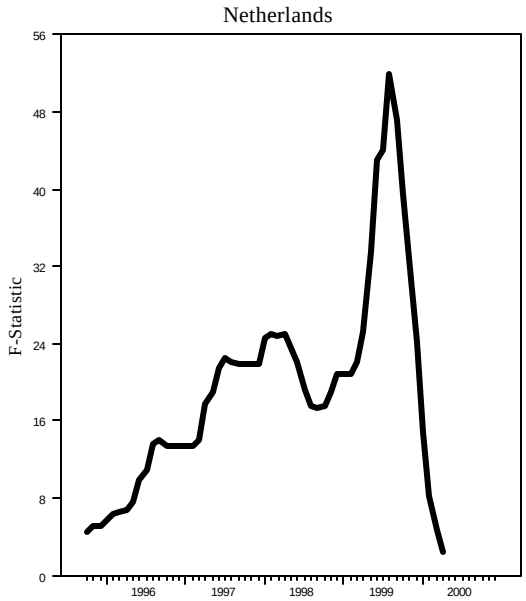


Figure 5, cont. Rolling Chow Tests for Cointegration of Real Lending Rates

Panel B. Consumer lending rates

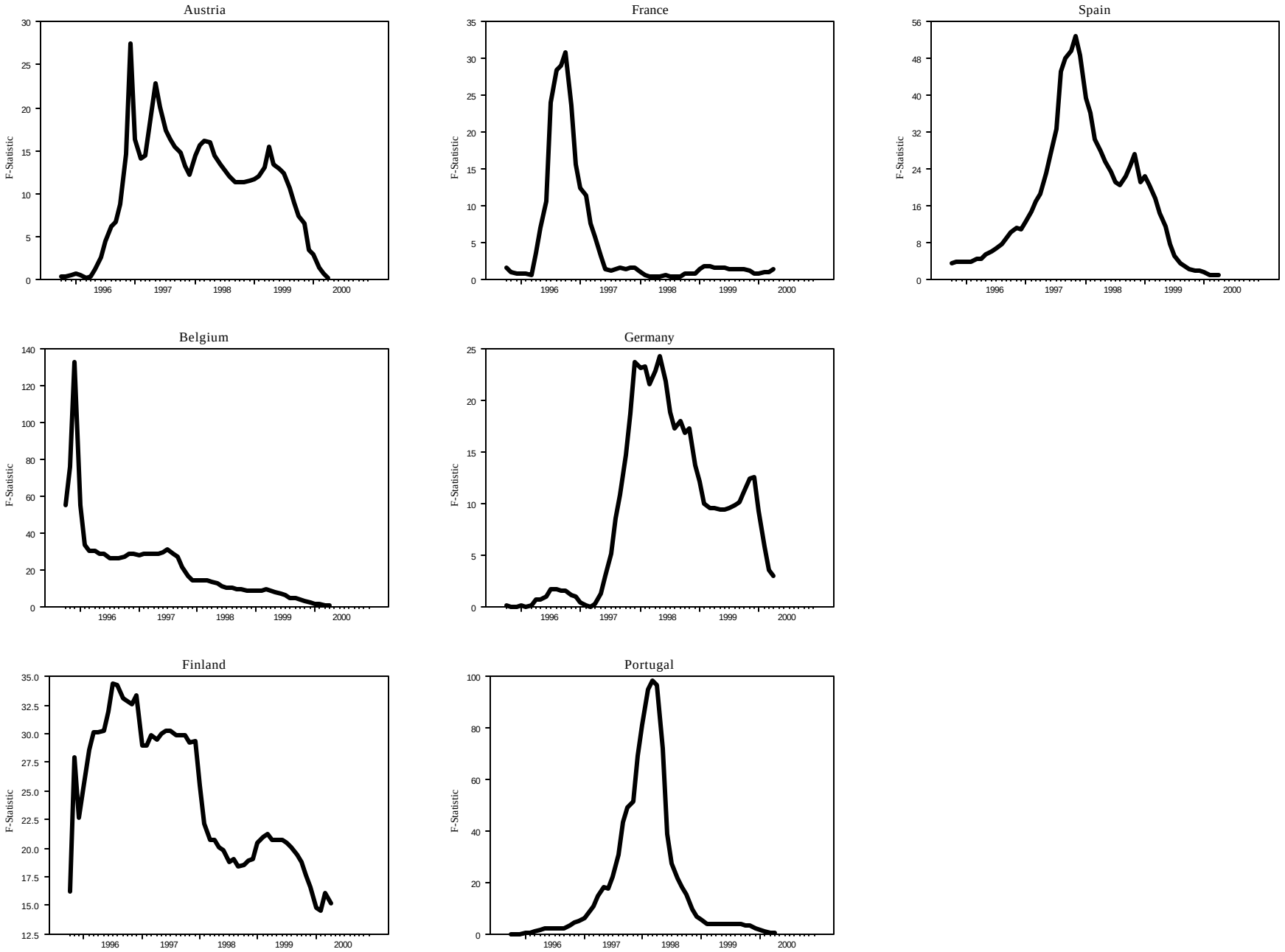
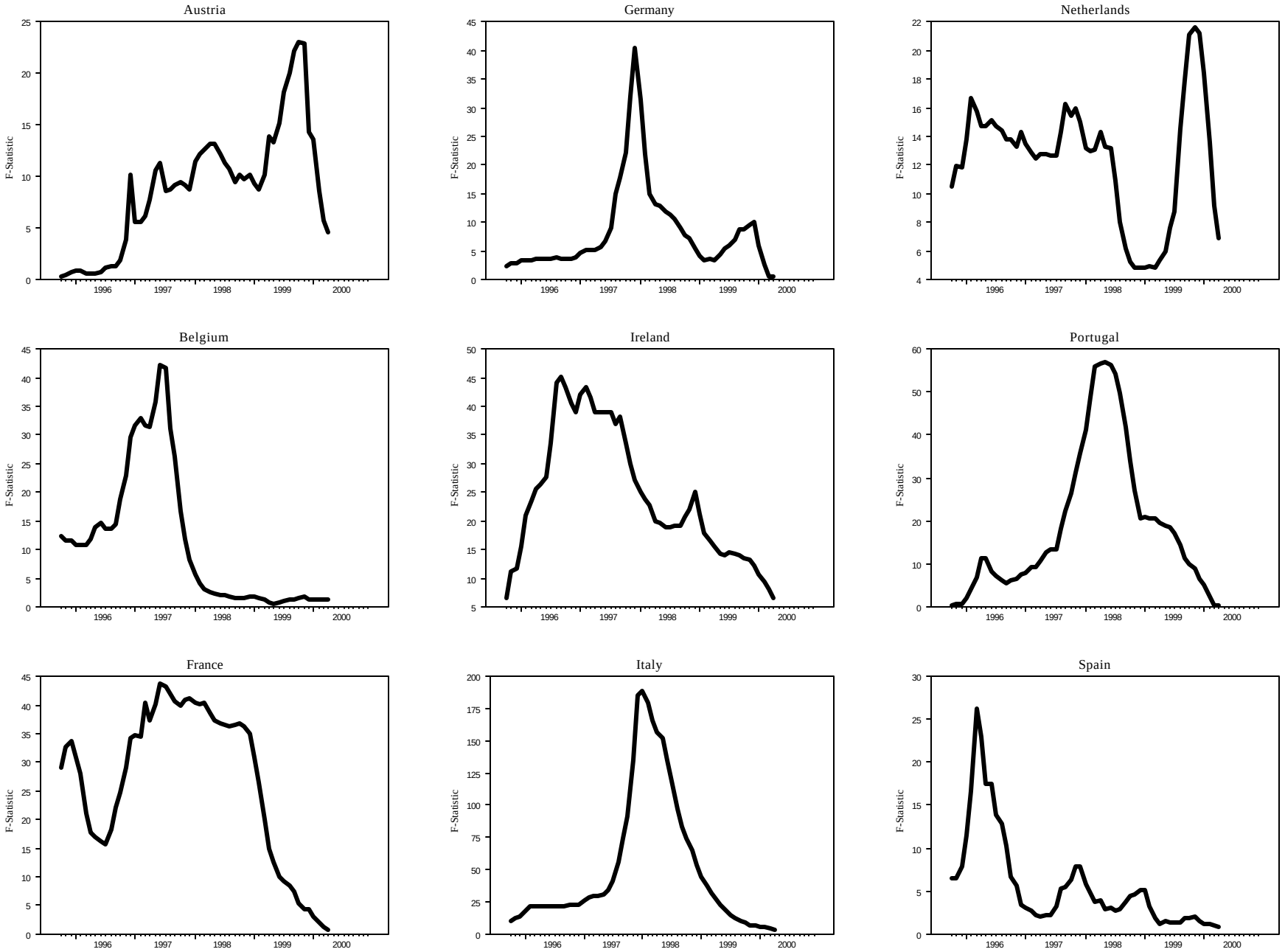


Figure 5, cont. Rolling Chow Tests for Cointegration of Real Lending Rates

Panel C. Corporate lending rates



Box 3. Testing for structural breaks

In the presence of important changes in the economic structure, such as the implementation of the 2nd Banking Directive or the adoption of a single currency, the long-run relationship between the interest rates in the eurozone could be affected, i.e. both parameters of the co-integrating regression may change in a statistically significant way. In order to test for such structural breaks in the co-integration relationship, we conduct a rolling Chow test which implies the following procedure: First, the co-integration regression as described in Box 2 using the national lending rate L_{nat} for the individual country as the dependent variable and the weighted average rate for the remaining EU countries L_{EU} as the independent variable

$$(3.1) \qquad L_{nat,t} = a + b\, L_{EU,t} + u_t$$

is estimated for the full sample ranging from April 1995 to December 2000. In the presence of a structural break, however, the DW, DF, and ADF co-integration tests have low power, i.e. the rejection frequency of the ADF test is clearly reduced (e.g. Gregory et al., 1996). Thus, in a second step, the co-integration vector is tested for structural breaks such that H_0: $a_{t1} = a_{t2}$ and $b_{t1} = b_{t2}$ with sub-samples t1 = 1 to k and t2 = k+1 to T. If k, the time of the break is known, the two samples t1 and t2 are clearly identified and a standard Chow test can be conducted. In our case, we consider a break to be likely around January 1999, but the exact timing of the break – if indeed there is one – is not known. Thus, rather than using a standard Chow test, a supremum F (supF) test is calculated. This test was first proposed by Quandt (1960) and has recently been the focus of various studies (e.g. Andrews, 1993, Diebold and Chen, 1996 and Hansen, 1992). In our single equation model, the supF test can be found by conducting a series of Chow tests. In particular, Chow tests are conducted for a series of different break points k, which move through the mid-80% of the sample. SupF equals the largest Chow F-statistic and is compared to critical values as reported by Hansen (1992). Depending on the model, the number of observations, etc., any estimated supF test statistic larger than approximately 15 will allow us to reject the null hypothesis of no structural break. Furthermore, the sequence of F-statistics can give an indication about the timing of the break.

In sum, we therefore are confident to continue the analysis with an EMU sub-period that is free of structural breaks. This is not always true for the pre-EMU period, but for the sake of comparability we have chosen the 1995-98 period. Since we are interested in the issue of the emergence of an integrated banking system, however, we particularly concentrate on the EMU period.

Based on our structural break tests, we conduct a co-integration analysis for the full period from and for both sub-periods, April 1985 to December 1998 and January 1999 to December 2000, respectively. If such a long-term relationship can be established, we speak of an co-integrated market. The degree of co-integration can then – and only then – be investigated within the "corresponding error-correction model" (ECM). This ECM allows us to estimate how fast the national interest rates are driven back to their long-run equilibrium relationship that they have with the remaining average European countries. The existence and the re-approach towards such a long-term relationship after a disturbance are interpreted as evidence for the existence of a uniform European retail banking market. Technically speaking, a coefficient on the error correction term has been estimated. The coefficient is typically between 0 and minus 1, and a value e.g. of -0.2 means that 20% of a deviation from the long-run relationship has been corrected in

every time period (here every month), while a value of -0.5 suggests that 50% of a deviation from long-run equilibrium has been corrected every time period. Clearly, the closer the coefficient is to -1, the faster is the adjustment process and the better integrated are the markets.

Figure 6 illustrates the results for nominal interest rates and Figure 7 for real interest rates. The figures are summarising the empirical testing for which the details are made available in Table A3 in the Annex. Only for countries and sample or sub-sample periods where bars are shown could a co-integration relationship be established. The absence of a bar therefore indicates that we do not find any evidence of co-integration of this country's lending market with the corresponding eurozone lending market (countries for which data are not available are clearly indicated with an N.A.). The height of the bars then simply indicates how fast the national rates are returning to the long-term equilibrium. It should be noted, however, that in some cases – despite the fact that co-integration has been accepted in the test procedures – the error-correction mechanism has not been found to be statistically significant at sufficiently high confidence levels. In such cases striped bars are used. Do we then find evidence for a uniform European retail banking market? The brief answers are "no" for mortgages, "no" for consumer lending and "maybe" for corporate lending.

Let us now go into more detail:

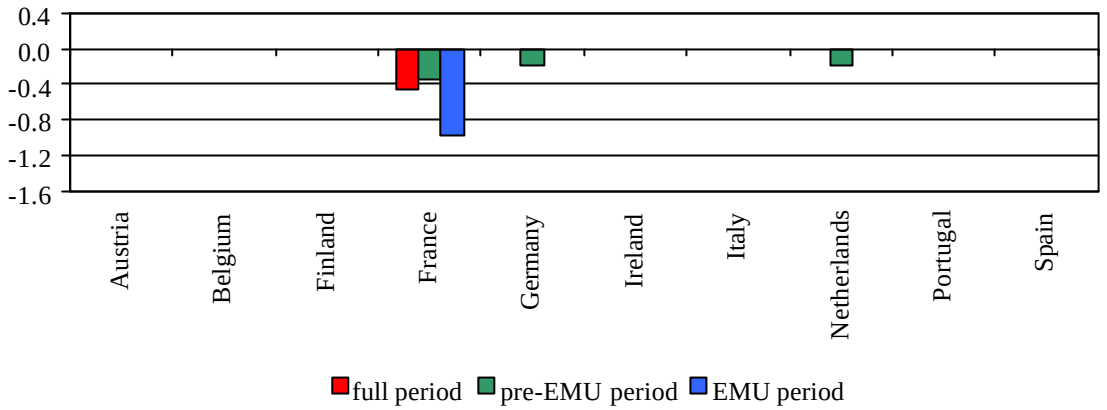
- As argued earlier, judgements about market integration based on interest rate convergence can be misleading. For example, nominal European mortgage rates are converging because they are by and large following developments in the money market rate. But as shown in our results here, they do not (yet) exhibit a long-term equilibrium relationship in most cases.
- Regarding nominal mortgage lending rates, we find evidence in favour of co-integration only for three countries, France, Germany and the Netherlands. Whereas co-integration can be found for all periods in France, co-integration is only present in Germany and the Netherlands for the pre-EMU period and – surprisingly – not for the EMU phase.
- While there is very little to almost no evidence of co-integration in mortgage markets in nominal terms, there is somewhat more, but still very limited evidence for co-integration for nominal consumer rates. For Finland, France, Germany, Portugal and Spain, we find a statistically significant adjustment process towards a long-term equilibrium relationship, but the speed of adjustment towards this equilibrium is very low for all countries except Portugal and France in the EMU period (see Figure 6, Panel B).
- For the corporate sector the evidence is pointing to more cases where nominal co-integration could be established in particular in the EMU phase, thus pointing to the more important role of competition (direct vs. indirect finance, etc.) in this sector. Specifically for Austria, Ireland, Italy, the Netherlands, Portugal and Spain, we find a significant speed of adjustment towards the long-run equilibrium relationship in the EMU period. Moreover, the speed of adjustment is higher than for consumer rates and ranges from -0.4 to -0.7 thus implying a time period of 2.5 to 1.5 months (see Panel C of Figure 6).

- In real (inflation-corrected) terms there is some more evidence in favour of co-integration in mortgage rates, despite the fact that real mortgage rates diverge more than nominal ones because of the inflation differentials in the first two years of EMU. Here – and in particular in the EMU-phase – co-integration can (now!) be found for Austria, Finland, Germany, the Netherlands, Portugal and Spain (see Figure 7, Panel A). For real consumer lending rates, however, we find less evidence of co-integration with respect to the number of countries, but in these four countries the speed of adjustment is higher than for mortgage rates. The mortgage rate results may reflect the fact that borrowers extensively compare prices nationally, that the national markets are more competitive and that inflation expectations play an important role in the long-term-oriented mortgage market. In consumer lending the sketchier evidence for co-integration may point to a less competitive environment often characterised by high switching costs.
- The strongest results for co-integration in real borrowing costs can be found for corporate rates. Austria and Spain show significant error correction mechanisms in all periods; France and Portugal in both sub-periods, and the results for Belgium, Germany and Italy indicate co-integration in the EMU period.

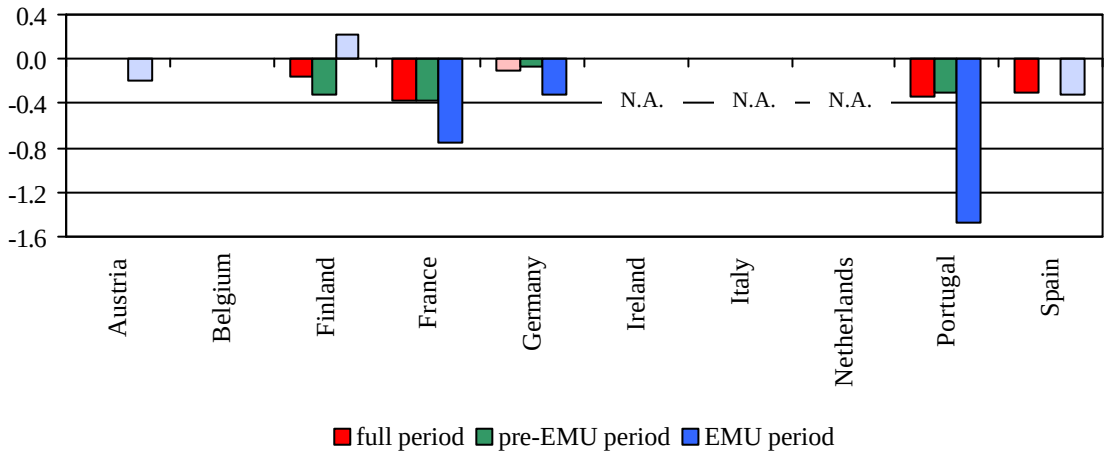
In sum, we find (almost) *no* evidence of a uniform banking market for mortgages. The picture differs slightly if one turns from nominal to real lending rates. Here mortgage rates appear to be more co-integrated, i.e. households' real costs of mortgage borrowing are more likely to follow similar structural trends in the eurozone. The evidence of co-integration in consumer credits is also sketchy, again slightly more so for nominal than for real rates. Our conclusion is therefore also a (maybe) "no". But we do find quite some evidence for more unified corporate lending in the EMU phase from nominal as well as real rate analysis. A "maybe yes" might therefore be justified, in particular in the EMU phase. Our "no, no, and maybe" conclusion is, however, subject to three reservations. First, and as mentioned before, our sample size is for obvious reasons very limited for the EMU period, thus reducing the validity of the conclusions. Second, as the effects of the single currency unfold, the rather sketchy evidence of integration to date may increase. Finally and most importantly, equating evidence in favour of co-integration with integrated markets can be misleading. Co-integration in banking may not be brought about by cross-border lending, mergers and acquisitions or international arbitrage. Rather, the statistical evidence of co-integration under the condition of a single monetary policy may simply reflect a smooth and homogeneous pass-through of monetary policy rate changes onto lending rates in all EMU members. The latter phenomenon is investigated in the following chapter.

Figure 6. Speed of adjustment in co-integration of nominal national interest rates versus EU average

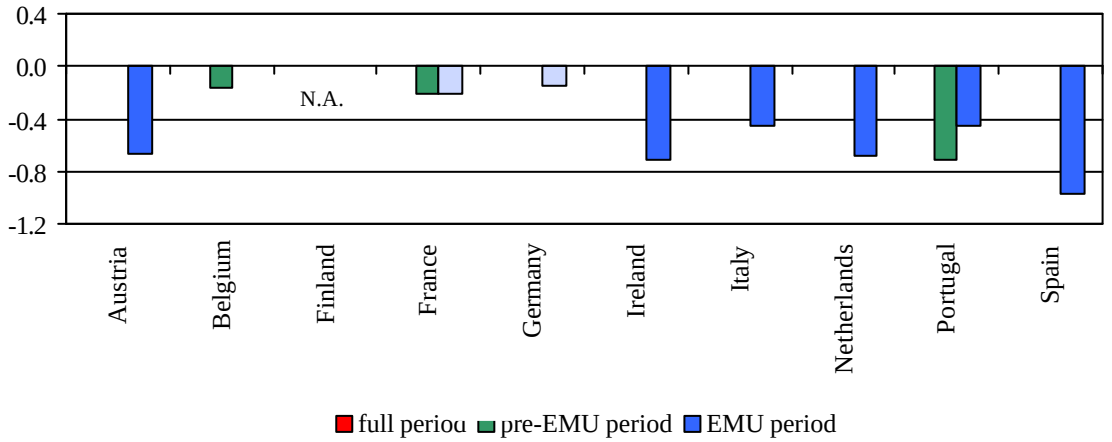
Panel A. Error correction terms for nominal mortgage rates



Panel B. Error correction terms for nominal consumer rates



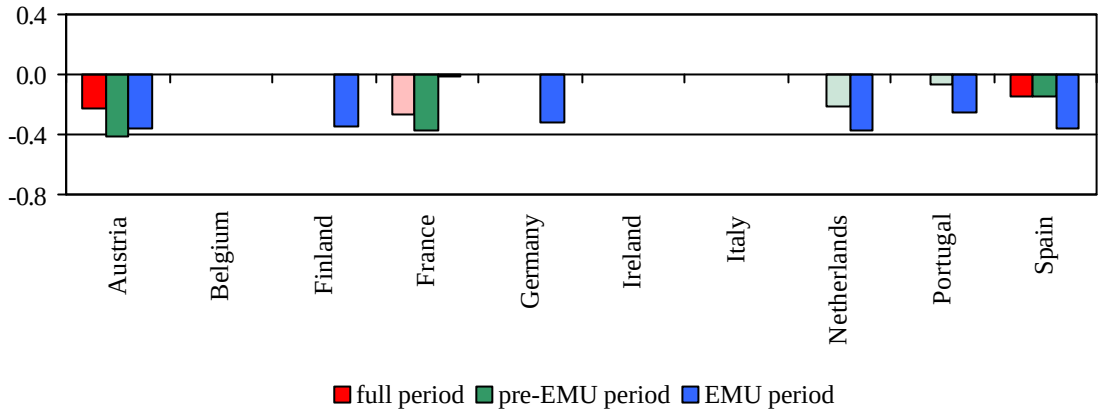
Panel C. Error correction terms for nominal corporate rates



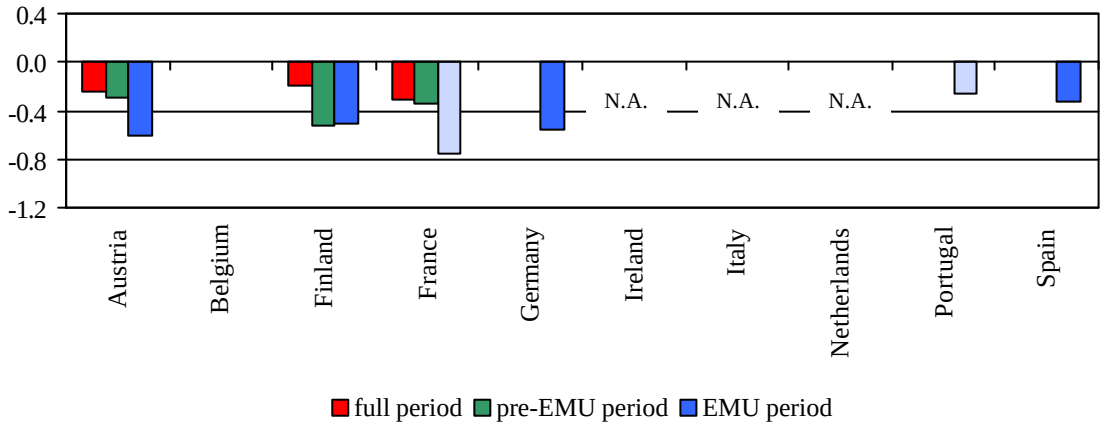
Note: Striped bars indicate that ECT is not significantly different from zero. N.A. = not available.

Figure 7. Speed of adjustment in co-integration of real national interest rates versus EU average

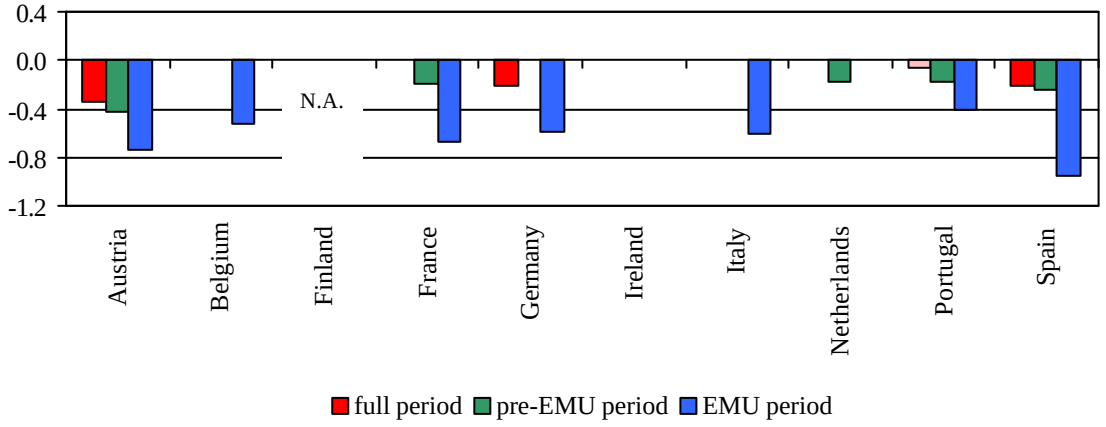
Panel A. Error correction terms for real mortgage rates



Panel B. Error correction terms for real consumer rates



Panel C. Error correction terms for real corporate rates



Note: Striped bars indicate that ECT is not significantly different from zero. N.A. = not available.

CHAPTER IV

PASS-THROUGH OF INTEREST RATE CHANGES TO LENDING RATES: A STILL ASYMMETRIC EUROZONE BANKING SECTOR?

Evidence of co-integration in lending markets can be produced by three mechanisms: arbitrage, (threat of) international competition and a uniform monetary policy impact on lending rates. Based on the few cases in which we found co-integration, one cannot directly identify arbitrage and competition as the driving mechanisms. In this case, retail interest rates could in principle follow the same time pattern if banks in the different eurozone countries would pass changes in policy-related interest rates smoothly and with the same speed onto lending rates. On the other hand, the cases in which we did not find co-integration indicate not only a lack of arbitrage and international competition but also an ineffective and/or heterogeneous monetary policy impact on lending rates. An ineffective pass-through of interest rates could be interpreted as pointing to a high degree of imperfect competition in retail banking (Cottarelli and Kourelis, 1994). A heterogeneous pass-through could be interpreted as limited institutional convergence in eurozone banking (Kleimeier and Sander, 2000). Thus, the investigation of the limitations and differences in the pass-through of interest rates in the eurozone can provide indirect evidence about forces driving or limiting the emergence of a unified eurozone retail banking market.

Following Cottarelli and Kourelis (1994), a growing literature discusses the response of lending rates to monetary-policy impulses as an important part of the monetary transmission process. These approaches typically model the transmission process in a dynamic model for the lending rate such as

$$(3) \qquad L_t = \beta_1 + \beta_L L_{t-1} + \beta_M M_t + \varepsilon_t$$

where L_t and M_t are the national lending and money market rates, respectively. The estimated coefficient $ß_M$ is the impact multiplier. A value of less than 1 indicates sluggish adjustment of lending rates to money market rates, also known as lending-rate stickiness.[10] This leads to a partial adjustment process over time towards a long-run equilibrium. In the long run, when the lending rate reaches its steady state value for any given value of the money market rate, i.e. L_{t-1} equals L_t, equation 3 takes the form of:

$$(4) \qquad L_t = \theta_0 + \theta M_t + u_t$$

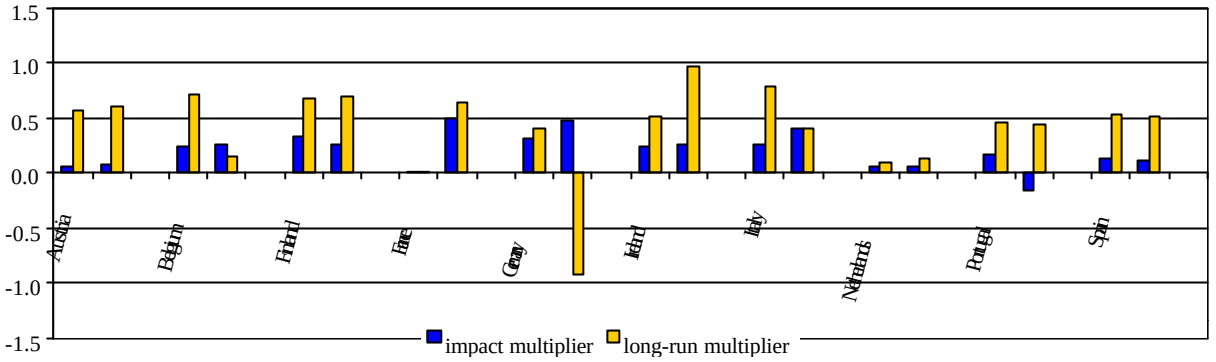
Cottarelli and Kouralis (1994) argue that this formulation is consistent with the monopolistic competition model relating the lending rate to the money market rate. If θ is equal to one, we speak of a full pass-through in the long-run, while the parameter θ_0 then reflects the mark-up over costs in the pricing policies of the banks.

In investigating the pass-through in the eurozone, we estimate first a somewhat refined version of the above-mentioned pass-through model, which is described in more detail in Box 4. The impact and long-run multipliers are listed in Table A4 and visualised in Figure 8.

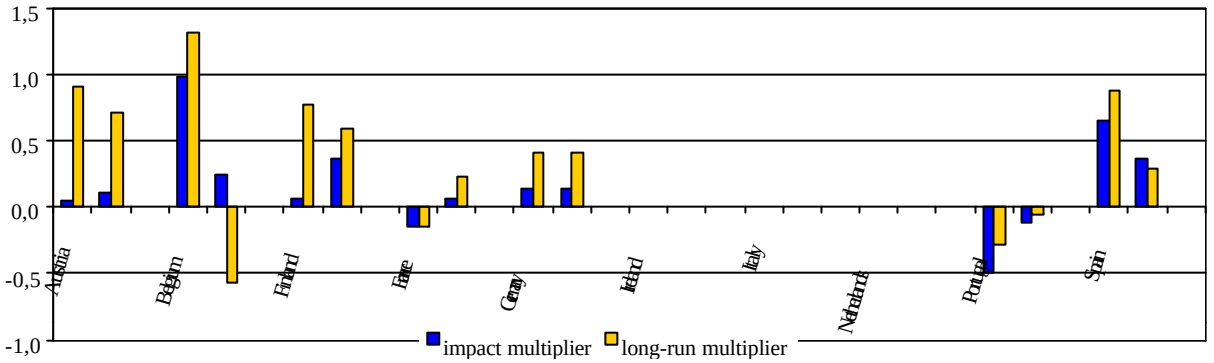
[10] The study by Corvoisier and Gropp (2001) confirms that increases in concentration in the eurozone banking sector can make the transmission of monetary policy to lending rates more sluggish.

Figure 8. Multipliers for the standard pass-through model

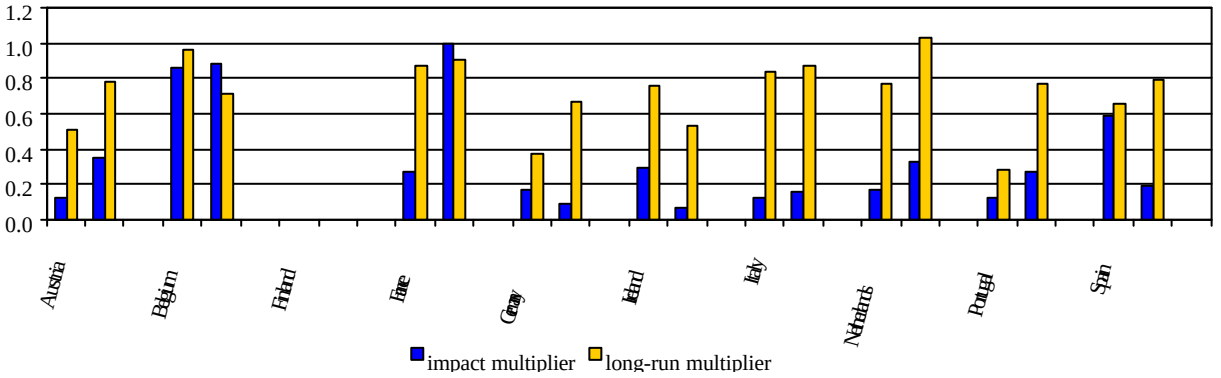
Panel A. Mortgage lending rates



Panel B. Consumer lending rates



Panel C. Corporate lending rates



Note: For each country, the left-hand side bars indicate the pre-EMU period, whereas the right-hand side bars indicate the EMU period.

Among the most important results are:

- The impact multipliers are in most cases far below 1, indicating a limited pass-through of interest rate changes. Exceptions are in particular corporate lending rates in Belgium and France and consumer rates in Belgium.
- Even in the long-run, the pass-through is far from perfect. However, the long-run pass-through works best in corporate lending rates and worst in consumer lending rates. This result corresponds to our no-no-maybe finding in the co-integration analysis and points to the fact that next to a lack of cross-border lending, a limited interest rate pass-through is the second cause for the lack of integration.
- For all three rates, it is also evident from Figure 8 that the pass-through mechanism differs greatly across countries in both the short-run and the long-run, again explaining the lack of integration in the presence of a single monetary policy.
- Comparing the size of the multipliers over time shows evidence for an increase in the impact multipliers in 6 out of 10 countries for mortgage rates, in 4 out of 7 countries for consumer rates and in 6 out of 9 countries for corporate rates. The long-run multiplier increased for 5 out of 10 countries regarding mortgage rates, for 2 out of 7 countries regarding consumer rates, and for 7 out of 9 countries regarding corporate rates. Again, this result is in line with our co-integration analysis where we find slightly more evidence for integration in the EMU period.

In sum, the pass-through process is still far from perfect and exhibits strong asymmetries across countries, thus going some way towards explaining the lack of integration. However, there are some improvements in the pass-through process in the EMU period, which are concentrated on corporate lending whereas the least improvements can be observed in consumer lending. Overall, this stresses the potentially important role of the introduction of the single currency, provided it is supported by a regulatory and competitive framework that promotes a smooth pass-through for creating a unified retail banking market.

The standard pass-through model has become a useful instrument for estimating the effects of monetary policy on lending. Nonetheless it has a number of drawbacks in particular for our problem:

- The results for the standard pass-through model can be misleading in cases where money market and lending rates are co-integrated. In such cases the standard pass-through model should be extended by including a measure for the error correction mechanism that brings lending rates back to their equilibrium relation with the money market rate after a disturbance has occurred. This mechanism is typically not covered in Cottarelli-Kourelis type of models.
- The standard model views the pass-through mechanism as symmetric in nature, regardless of whether interest rates move upward or downward, below or above a long-run equilibrium or whether their adjustment speed is accelerating or decelerating. Such asymmetries are, however, important features of a financial system, influencing not only the pass-through of interest rates but also revealing much about the heterogeneity of financial systems in the eurozone.
- Banks may not always adjust lending rates immediately when monetary policy-determined rate are being changed, but rather tend to smooth out smaller changes,

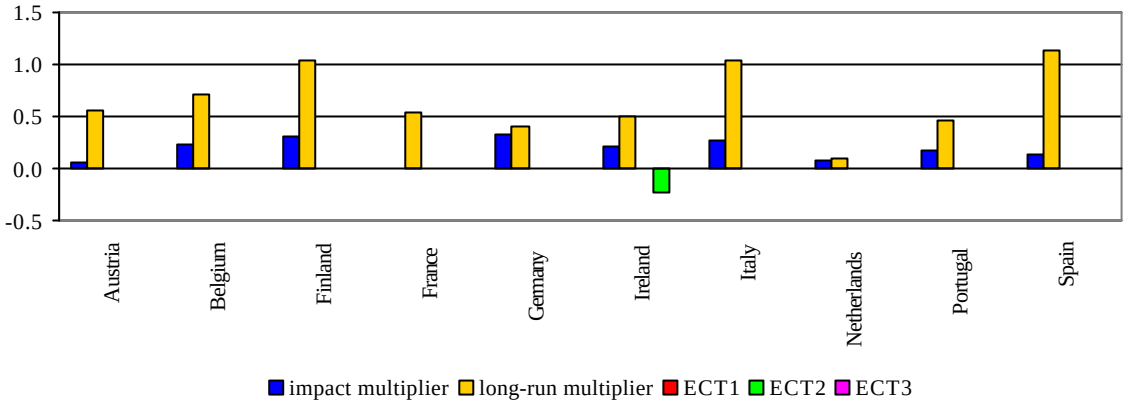
either to reduce or avoid adjustment costs of changing prices (the so-called "menu costs") or because they are providing an implicit insurance for their customers against interest-rate fluctuations with a view to maintaining a long-run customer relationship. Such mechanisms have been investigated with so-called "threshold-adjustment" models, which explicitly allow for adjustments only when a certain threshold (a deviation from a long-run relation between the money market and lending rate) is exceeded. Such models can do both: optimise the threshold and estimate the (asymmetric) adjustment process itself.

We re-estimated the pass-through processes in the eurozone by making use of a number of alternative pass-through model specifications that are being described in Box 4 in detail. For detailed statistics on the various estimated models and the model selection, the reader is referred to Table A5 in the Annex. On the basis of these analyses, we selected the most suitable pass-through model for each combination of interest rate, country and time period. These models are able to detect co-integration under conditions of asymmetry and threshold behaviour – co-integration that would otherwise remain undetected and could lead to a premature conclusion of limited competition in the banking sector. The results of this exercise can be found in Table A6 in the Annex and are visualised in Figures 9 and 10. Among the most important results we obtain are the following:

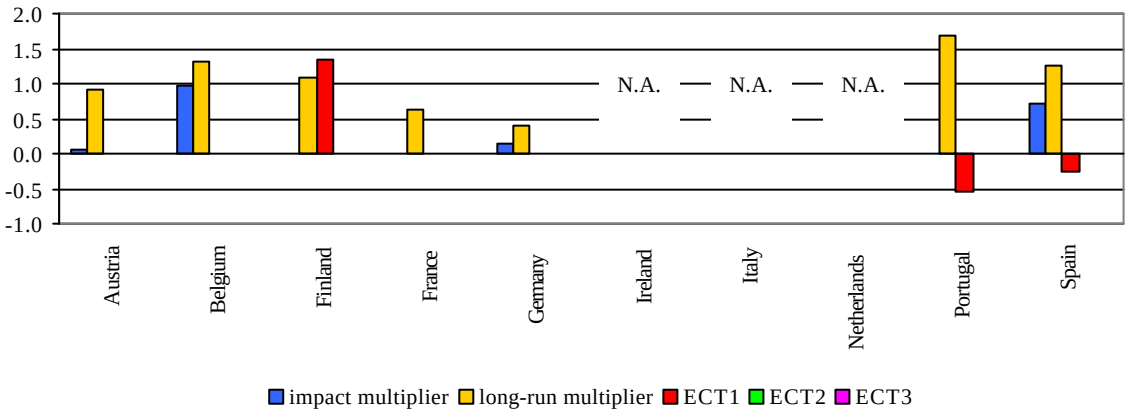
- The impact multipliers are once again in most cases far below 1. Likewise, even in the long-run, we do not always find a full pass-through. Comparing across countries, the asymmetry can also be found in this extended model. As in the standard model, the pass-through is least efficient in consumer lending. Furthermore, the earlier result of a smoother pass-through in the EMU phase is confirmed with again the exception of the consumer lending market.
- The extended model provides estimates of the adjustment process towards the long-run equilibrium. Such an error correction mechanism indicates the speed of adjustment. We find limited evidence for such a mechanism in the pre-EMU period, but this evidence strengthens in the later EMU period. Again, consumer lending shows the fewest significant adjustment mechanisms.
- A second important novelty of our extended model is the analysis of the changing nature of the adjustment process. The results show that there is no predominant model that fits all lending markets and countries. Rather, we find that in some cases lending rates are adjusting only when rates are sufficiently far from the equilibrium – that is, surpassing a certain threshold. In other cases, adjustment is differing when rates are moving upward or downward, or away or towards the equilibrium. In yet another case, adjustment takes place only when there is a fast and large movement away from equilibrium. For example looking to the EMU period, in corporate lending we find in 7 out of 9 cases either a symmetric adjustment or no adjustment process. Only in Portugal and Spain does an asymmetric threshold adjustment model seem to be more adequate pointing to the fact that banks shield their corporate customers from either small changes in interest rates (Portugal) or from small but rapid changes in interest rates (Spain).

Figure 9. Coefficients for the optimally extended pass-through model in the pre-EMU period

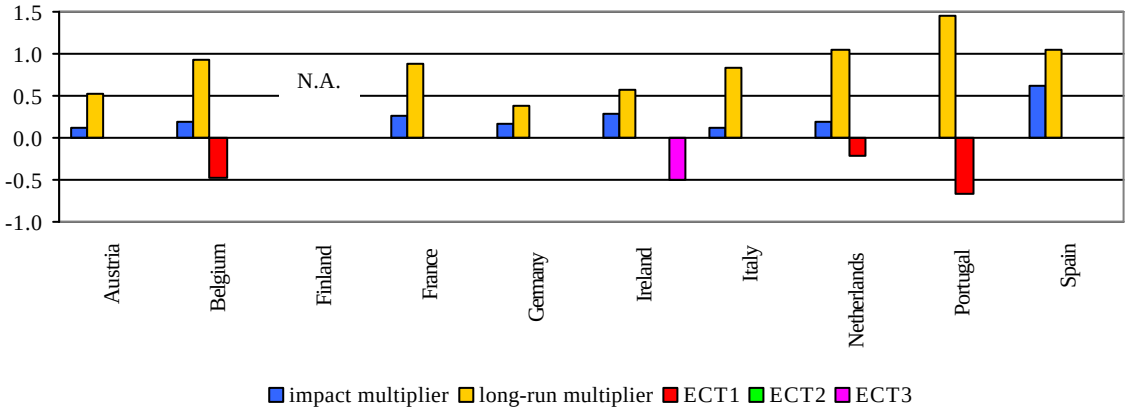
Panel A. Mortgage lending rates



Panel B. Consumer lending rates



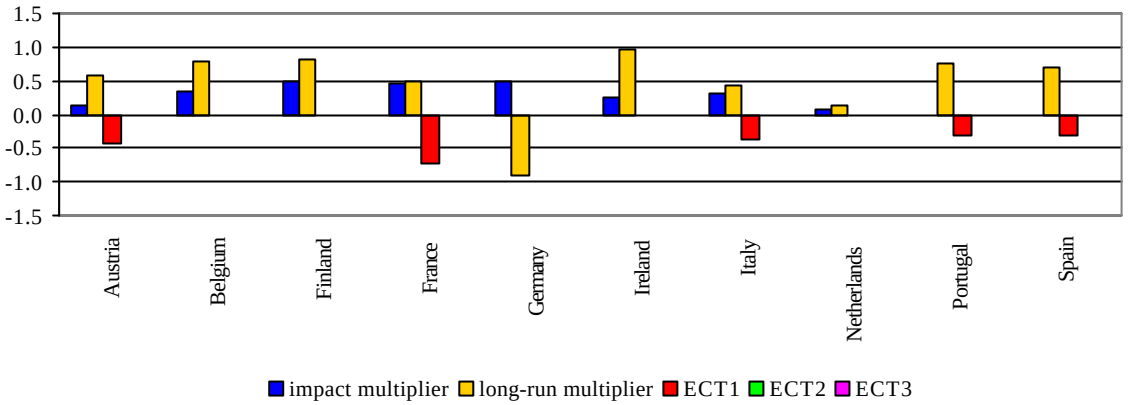
Panel C. Corporate lending rates



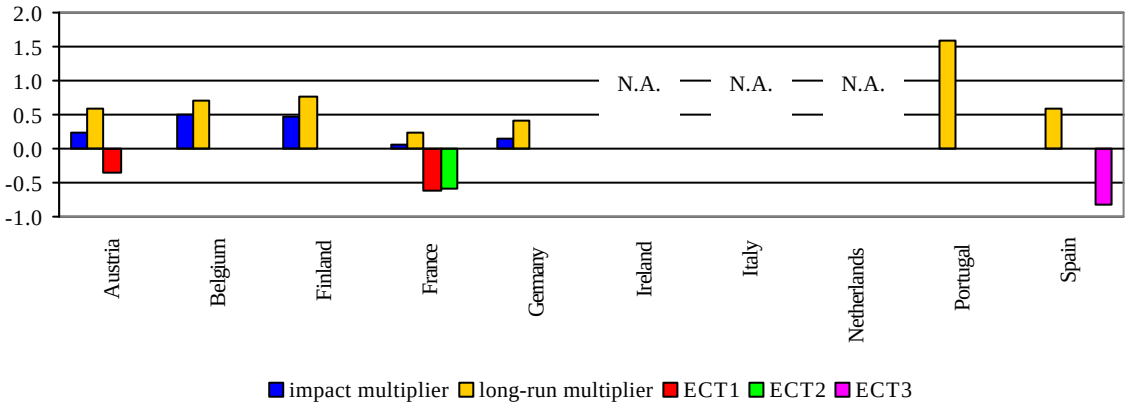
Note: Only significant impact multipliers and ECT coefficients are shown. N.A. = not available.

Figure 10. Coefficients for the optimally extended pass-through model in the EMU period

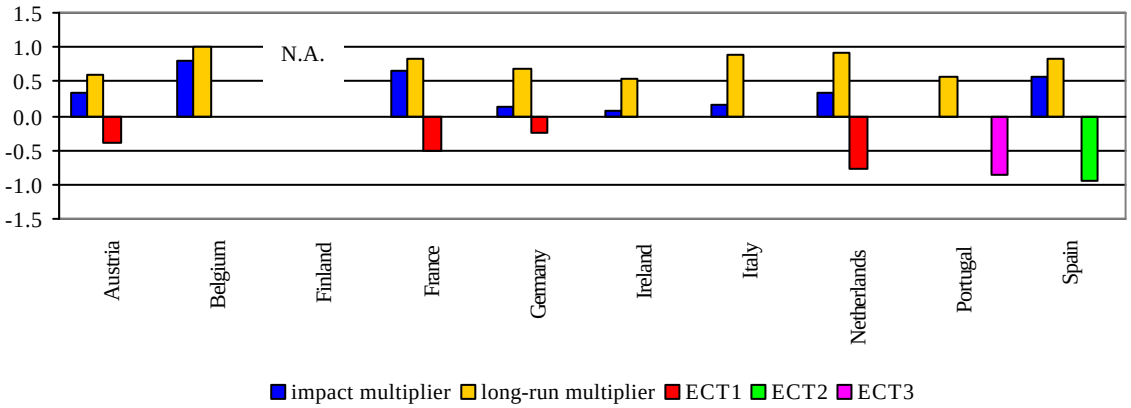
Panel A. Mortgage lending rates



Panel B. Consumer lending rates



Panel C. Corporate lending rates



Note: Only significant impact multipliers and ECT coefficients are shown. N.A. = not available

Turning now to consumer lending rates we find no adjustment mechanism in Germany, a symmetric one in Austria and Belgium and an asymmetric threshold adjustment in Finland, Portugal and Spain. In these three latter countries, lending rates are adjusted only after passing a certain threshold level, but even here the evidence is in most cases statistically not different from zero. France is an interesting exception as rapid movement of policy rates there are smoothed out.[11]

- Finally, also the extended models confirm the earlier result of heterogeneous pass-through in the eurozone. The heterogeneity as measured by the standard deviation of the long-term multipliers is the highest in consumer lending followed by mortgage and corporate lending. However, whereas in the latter two categories we find some evidence for a more homogeneous pass-through in the EMU phase, no improvements could be detected in consumer lending.

In sum, the transmission process from money-market interest rates to lending rates in the eurozone exhibits strong national characteristics, which are rooted in the specific features of the national finance and banking systems. While there is some evidence for the emergence of a smoother pass-through process in the recent EMU years, we are still a far way from a uniform banking system. These results are in line with the findings of a recent ECB study that suggests "that current 'country asymmetries' reflected in the response of bank rates to monetary policy should decrease over time by virtue of the implementation of the single monetary policy" (Mojon, 2000). In particular, the pass-through is more limited in the area of consumer credit in comparison to lending to the corporate sector. Overall, it appears that three factors are simultaneously important for creating a uniform retail banking market in the eurozone. The first factor is the potential impact of the single currency as suggested above. Secondly, further harmonisation of national legislation in particular in the area of consumer credit where harmonisation accomplished so far is limited (Diez Guardia, 2000). Along similar lines, national differences in taxation also go some way in explaining the lack of arbitrage, in particular for mortgage lending. Thirdly, additional regulatory efforts and pro-competition measures are needed to promote a smooth and more uniform pass-through of monetary policy changes.

[11] Regarding the results for Austrian mortgage rates in the EMU period, Finnish mortgage rates in the pre-EMU period, Dutch corporate rates in the EMU period and Portuguese corporate rates in the pre-EMU period, the results for the BTAR* model are unexpected. The coefficients of some ECTs are out of the expected range of -1 to 0. However, the optimal threshold in all these cases is close to zero. Thus, whereas the model is optimal from an econometric perspective, from an economic perspective it is difficult to interpret and might be misspecified. Therefore, in these cases we report in Figures 9 and 10, the coefficients from the symmetric model (SYM).

Box 4. Modelling the pass-through of monetary policy impulses onto lending rates

Beginning with Cottarelli and Kourelis (1994), a growing literature discusses the response of lending rates to monetary policy impulses as an important part of the monetary transmission process. These approaches typically model the transmission process in a dynamic model for the lending rate, such as

$$(4.1) \quad L_t = \beta_1 + \sum_{i=1}^{k^*} \beta_{L,i} L_{t-i} + \beta_2 M_t + \sum_{i=1}^{n^*} \beta_{M,i} M_{t-i} + \varepsilon_t$$

where L_t and M_t are the national lending and money market rates, respectively (where we omit the subscript "nat" because only national lending rates are part of the pass-through analysis and a distinction between national and EU-wide lending rates is not required in this context). k* and n* are defined as the model's optimal lag-length which is determined by the minimum AIC criteria for models with up to 4 lags.[1] Note that for k=1 and n=0, this model is equivalent to the illustrative model that we introduced in the text. The estimated coefficient $\hat{\hat{\alpha}}_2$ is the impact multiplier. A value of less than 1 indicates sluggish adjustment of lending rates to money market rates, also known as lending rate stickiness. The long-term multiplier can be calculated from (4.1) as

$$(4.2) \quad \hat{\varepsilon} = \frac{\hat{\hat{\alpha}}_2 + \sum_{i=1}^{n^*} \hat{\hat{\alpha}}_{M,i}}{1 - \sum_{i=1}^{k^*} \hat{\beta}_{L,i}}$$

In the long run equation (4.1) therefore has the form of

$$(4.3) \quad L_t = \theta_0 + \theta M_t + u_t$$

Cottarelli and Kourelis (1994) argue that this formulation is consistent with the monopolistic competition model relating the lending rate to the money-market rate. If θ is equal to one, we speak of a full pass-through in the long-run, whereas equation (4.1) models the partial adjustment process over time towards the long-run equilibrium in the case of lending rate stickiness, that is $\hat{\hat{\alpha}}_2 < 1$.

It is widely accepted that the time series for interest rates typically exhibit an I(1) property, that is, unit root tests cannot reject the null hypothesis of a random walk. Consequently, pass-through models such as equation (4.1) are regularly estimated in first differences to avoid spurious regression problems.

Next to the standard pass-through specification, we propose to base pass-through measurement on a well specified error-correction model that explicitly incorporates the long-run relationship between lending and money market rates provided the series are co-integrated.

$$(4.4) \quad \Delta L_t = \beta_1 + \sum_{i=1}^{k^*} \beta_{L,i} \Delta L_{t-i} + \beta_2 \Delta M_t + \sum_{i=1}^{n^*} \beta_{M,i} \Delta M_{t-i} + \beta_{ECT} ECT_{t-1} + \varepsilon_t$$

where ECT contains the estimated residuals $\hat{u}_{t-1}$ from the long-run equilibrium relationship defined by equation (4.3), provided such a relationship can be established by co-integration testing procedures corresponding to those described in Box 2.

This formulation has a number of advantages over the standard pass-through model of equation (4.1). First, next to the impact multiplier estimate, the long-run multiplier can directly be obtained from the co-integrating regression (4.3). The procedure is therefore computationally

more efficient (Moazzami, 1999). Second, we can directly obtain the speed of adjustment towards the long-run equilibrium via the estimated coefficient of the ECT in equation (4.4). Third, this error-correction specification allows us to analyse a variety of adjustment mechanisms – including the symmetric adjustment described in Box 2 but also alternative asymmetric adjustment – thus showing more openly the differences in the financial part of the monetary transmission mechanism. Moreover, using models with asymmetries allows us to detect co-integration in cases where there are asymmetries and where the Engle-Granger methodology of Box 2 would thus fail to detect co-integration. Finally, only in cases where no co-integration is present in the data is the standard pass-through model appropriate.

In particular, we are considering here five different specifications for asymmetric adjustment of interest rates.

The first model we consider is the threshold autoregressive model (TAR^0) developed by Tong (1983). The model makes a distinction depending upon whether the explained interest rate (lending rate in our case) is above or below its equilibrium level. Thus, the TAR^0 allows for asymmetric adjustment depending on the state of equilibrium-deviation. For example, if the money-market rate decreases without an immediate adjustment in the lending rate, we obtain a positive realisation of the error term u_t. When in this case the autoregressive decay is faster than in the case of money market rate increases, then the lending rate adjustment is faster downward than upward. An appropriate test procedure is to set a Heaviside indicator I_t for different states of $\hat{u}_{t-1}$.

$$(4.5) \quad I_t = \begin{cases} 1 & if \quad \hat{u}_{t-1} \geq 0 \\ 0 & if \quad \hat{u}_{t-1} < 0 \end{cases}$$

Using this definition, we test for co-integration by estimating equation (4.6), which represents a modification of the ADF test. The null of no co-integration is rejected if the estimated F-statistic for H_0: $\rho_1 = \rho_2 = 0$ is insignificant based on critical values provided by Enders and Siklos (2000).

$$(4.6) \quad \Delta\hat{u}_t = I_t \rho_1 \hat{u}_{t-1} + (1 - I_t) \rho_2 \hat{u}_{t-1} + \sum_{i=1}^{m^*} \rho_{2+i} \Delta\hat{u}_{t-i} + \varepsilon_t$$

with the optimal lag length m* determined via the minimum AIC criteria for models with up to 4 lags. When co-integration is established, an F-test for equality of ρ_1 and ρ_2 indicates the presence of asymmetry.

The next model (TAR*) is a modification of the TAR^0 in the sense that the threshold that was formerly implicitly set at zero is now allowed to deviate from that value. The rationale behind such a non-zero threshold is that one or both variables may only adjust to a dis-equilibrium once it exceeds a certain minimum deviation in one direction. For example, the lending rate will adjust fast only when out of an equilibrium situation the money-market rate drops in a way that the deviation from equilibrium exceeds an optimal threshold of, say, 0.5 percentage points. For lower deviations or increases in the money market rate, adjustment takes place at a significantly slower pace. Now the Heaviside indicator in conjunction with equation $(4.6)^2$ is defined as

$$(4.7) \quad I_t = \begin{cases} 1 & if \quad \hat{u}_{t-1} \geq a_0^* \\ 0 & if \quad \hat{u}_{t-1} < a_0^* \end{cases}$$

In accordance with Chan (1993), the optimal threshold a_0* is found by searching over the mid-80% of the distribution of $\hat{u}_t$ and selecting the model for which the residual sum of squares is minimised. Co-integration and asymmetry testing proceeds with the above described F-tests.

The third variation is a Band-TAR model (B-TAR*), which defines the Heaviside indicator as

$$(4.8)\quad I_1 = \begin{cases} I_1 = 1 & \text{if} \quad \hat{u}_{t-1} \geq a_0^* \quad \text{and} \quad 0 \quad \text{otherwise} \\ I_2 = 1 & \text{if} \quad |\hat{u}_{t-1}| < a_0^* \quad \text{and} \quad 0 \quad \text{otherwise} \\ I_3 = 1 & \text{if} \quad \hat{u}_{t-1} < -a_0^* \quad \text{and} \quad 0 \quad \text{otherwise} \end{cases}$$

while equation (4.6) has to be modified to

$$(4.9)\quad \Delta\hat{u}_t = \sum_{j=1}^{3} \rho_j I_j \hat{u}_{t-1} + \sum_{i=1}^{m^*} \rho_{3+i} \Delta\hat{u}_{t-i} + \varepsilon_t$$

Procedures for optimal lag length m* and optimal threshold a_0* are corresponding to those of the TAR* and the F-tests for co-integration and asymmetry are applied to all three coefficient ρ_j. Such a model has often been applied in particular to model interest rate co-integration where infrequent and discrete adjustments in the rates occur (Balke and Fomby, 1997, Baum and Karasulu, 1998). For example, if deviations from equilibrium are small and will therefore not lead to an adjustment of the dependent interest rate, one may find no co-integration within a narrow band bordered by a_0* and $-a_0$*, while outside this band co-integration and thus an error correction mechanism may be present. In the context of our study, such behaviour could be related to the "menu-cost" argument of lending-rate stickiness such that banks only adjust lending rates when deviations are sufficiently large. However, if it would happen that inside the band co-integration is found but not outside, this could indicate that banks implicitly insure their customers against excessive deviations from equilibrium by smoothing the response of the lending rate.

In the TAR models the autoregressive decay always depends on the degree of deviation from equilibrium. One could also make an image of situations where the adjustment speed depends on how fast the rates move away from or towards equilibrium. Enders and Granger (1998) therefore propose a momentum threshold autoregressive model (M-TAR) where the Heaviside indicator depends as follows on the change in error-correction term, $\Delta\hat{u}_t$

$$(4.10)\quad I_t = \begin{cases} 1 & \text{if} \quad D\hat{u}_{t-1} \geq a_0 \\ 0 & \text{if} \quad D\hat{u}_{t-1} < a_0 \end{cases}$$

Similar to the TAR^0 and TAR* specifications, the threshold in the M-TAR can either be set at zero leading to the M-TAR^0 specification or be optimised at a_0* leading to the M-TAR* specification. Co-integration and asymmetry testing proceeds based on equation (4.6) above. The M-TAR models have successfully been applied to the term structure of interest rates by Enders and Granger (1998) and Enders and Siklos (2000). According to the latter authors, M-TAR adjustment can be especially useful when decision-makers (in our case banks) are viewed as attempting to smooth out large changes in a series.

Based on the co-integration testing, we selected the appropriate model for analysing the pass-through of interest rates. In the case where no co-integration was found, we use the standard pass-through model (STD). This can be done by estimating the error correction model of equation (4.4) with β_{ECT} set to zero. For this as well as for all other specifications of equation (4.4), we have chosen an optimal lag length k* and n* for lending and money market rates, respectively, by applying the minimum AIC criteria for all models with up to 4 lags in either rate. Consequently, in the STD model the impact multiplier is given by the estimated coefficient $\hat{\hat{a}}_2$ and the long-run multiplier θ is calculated according to equation (4.2).

When co-integration was found, the long-run multiplier θ is directly obtained from the co-integrating regression (4.3), while again the impact multiplier is $\hat{\hat{a}}_2$ obtained from the appropriate specification of equation (4.4). The error-correction mechanism itself depends on the optimal model. In the case of the symmetric co-integration model (SYM), the ECT is equal to the estimated residuals of the co-integrating regression. β_{ECT} is therefore estimating the speed of a symmetric adjustment process towards a long-run equilibrium. In the models with asymmetric adjustment, β_{ECT} and the ECTs are 2-dimensional or, in the case of the B-TAR*, 3-dimentional vectors which give the speed of adjustment depending on the definition of the ECTs of equations (4.5), (4.7), (4.8), or (4.10), respectively. Furthermore, where appropriate, the value of the optimal threshold a_0* is reported.

Endnotes

1. Due to the small sample size of the EMU period, the models with the fewest lags whose error terms fulfil the white-noise requirement – established via the Ljung-Box Q-test – are selected.

2. For both, the TAR* and the following B-TAR* model, the optimal lag length m* of the TAR^0 specification is used.

CHAPTER V
CONCLUSIONS

Our study provides new evidence on the emergence of a unified European retail banking market, with a particular emphasis on consumer credit. The *first* point we stress is that the empirical artefact of converging nominal and real lending rates cannot simply be read as a sign for an integrating retail banking market. Such rates follow – often however with considerable delay – the changes in central bank-determined interest rates, that is, convergence of lending rates could be the consequence of convergence of monetary policy and not of market integration. *Secondly*, we therefore suggest basing our judgement on the existence of a uniform banking market on a co-integration analysis. In doing so, we find very limited evidence for co-integration in particular before 1 January 1999, that is, the introduction of the single currency. The 2nd BD and other regulation efforts in order to create a single lending market appear to have been of a limited effect in this respect. *Third*, we find that the relationship of national lending markets with the remaining eurozone lending markets exhibits strong signs of structural changes that have come about with the introduction of the single currency on 1 January 1999. This result should not be underestimated as it indicates that eurozone credit markets are changing dramatically, although it is clearly too early to provide definite evidence or to draw definite conclusions on integration from this evidence. *Fourth*, we provide, however, a first picture of the emerging (uniform) eurozone banking market based on the limited database that is available so far. In this exercise we found, *fifth*, that there are some tendencies for a more uniform corporate lending market, while consumer lending markets are still more fragmented. *Sixth*, we identify three driving forces towards a uniform banking market: Cross-border borrowing and lending (arbitrage), a national and international retail banking environment, and a smooth and uniform pass-through of interest rate changes onto lending rates. Regarding the first point, lending is still a very much localised activity and may eventually remain so. For an effective arbitrage process, a much higher level of harmonisation is needed in particular in the field of consumer credit. If, however, cross-border lending is limited, this lack of internationalisation of lending could have been compensated for by a competitive behaviour of loan pricing. On the one hand, increased competition would decrease lending spreads. Our descriptive analysis has delivered no clear evidence in favour of the increased competition hypothesis and is in line with the more sophisticated empirical work by Corvoisier and Gropp (2001). On the other hand, more competition should lead to a smoother pass-through of monetary-policy changes onto borrowers. Our study finds that also in this respect consumer credit lending is lagging behind its corporate-lending cousin. Consequently, improving the competitive environment in retail banking could not only significantly benefit the borrowers but also help to unify the eurozone retail banking market.

Since a single retail banking market "does not simply relate to the free movement of services and capital, but also involves the concept of consumers shopping around" (Diez Guardia, 2000, p. 29), it is clear that integration is slow. In the debate over "whether these problems are structural (to be addressed by competition policy or economic regulation) or information-related" (Ibid.), our results point to the role of structural factors in the presence of a still-infant arbitrage process. A tentative conclusion is that a more unified European retail banking markets may require additional efforts in

harmonisation – in particular in the field of consumer credit as well as intensified competition supported by adequate regulation and competition policies within countries in order to speed up the pass-through process. Integrating financial markets is in itself not a guarantee that a competitive market for consumer credit will be established in the eurozone. Nonetheless, even our first and preliminary results also suggest that the introduction of the single currency already has had and will most likely continue to have an important impact on the emergence of a single eurozone retail banking market. The direction these developments take needs to be closely monitored for all different products in consumer credit in order to fully obtain the benefits promised earlier to consumers with the single market initiative.

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TABULAR ANNEX

Table A1. Nominal and real cost of borrowing and interest rate spreads in EMU – Descriptive statistics

Country	Mortgage lending rates						Consumer lending rates						Corporate lending rates					
	Full		Pre-EMU		EMU		Full		Pre-EMU		EMU		Full		Pre-EMU		EMU	
	Mean	Stand. dev.	Mean	Stand. dev.	Mean	Stand. dev.	Mean	Stand. dev.	Mean	Stand. dev.	Mean	Stand. dev.	Mean	Stand. dev.	Mean	Stand. dev.	Mean	Stand. dev.
Panel A. Nominal cost of borrowing																		
Austria	6.28	0.79	6.64	0.65	5.59	0.51	7.83	0.95	8.29	0.79	6.96	0.54	6.71	0.80	7.05	0.69	6.06	0.53
Belgium	6.02	0.82	6.07	0.85	5.92	0.79	7.82	1.46	8.16	1.65	7.20	0.66	4.60	0.66	4.58	0.51	4.62	0.89
Finland	5.95	1.11	6.36	1.07	5.19	0.72	7.15	1.17	7.58	1.16	6.34	0.69						
France	7.47	1.18	8.07	1.01	6.36	0.44	9.66	1.28	10.31	1.12	8.44	0.22	5.99	1.51	6.56	1.50	4.91	0.75
Germany	6.03	0.74	6.17	0.70	5.75	0.76	11.06	0.86	11.47	0.80	10.30	0.24	7.95	0.47	7.95	0.39	7.96	0.62
Ireland	6.44	1.14	7.17	0.46	5.07	0.63							9.60	0.80	10.03	0.49	8.79	0.63
Italy	9.30	3.13	11.09	2.38	5.96	0.44							8.89	2.74	10.48	2.01	5.92	0.54
Netherlands	6.17	0.67	6.31	0.63	5.90	0.68							3.78	0.67	3.59	0.50	4.13	0.82
Portugal	8.37	2.83	9.88	2.32	5.52	0.71	12.40	3.33	14.05	3.01	9.31	0.46	6.39	2.14	10.22	2.49	5.56	0.58
Spain	7.23	2.32	8.27	2.23	5.29	0.63	10.30	2.64	11.54	2.45	7.97	0.58	7.01	1.22	7.35	2.03	4.60	0.76
Panel B. Real cost of borrowing																		
Austria	4.91	0.55	5.20	0.29	4.43	0.64	6.47	0.69	6.85	0.41	5.80	0.63	5.34	0.54	5.61	0.31	4.90	0.66
Belgium	4.42	0.87	4.68	0.89	4.01	0.80	6.24	1.58	6.77	1.67	5.29	0.73	2.99	0.69	3.20	0.74	2.72	0.69
Finland	4.51	1.54	5.25	1.36	3.18	0.80	5.71	1.59	6.47	1.41	4.33	0.75						
France	6.14	0.88	6.63	0.61	5.16	0.34	8.33	1.03	8.88	0.73	7.25	0.54	4.64	1.11	5.13	1.06	3.78	0.55
Germany	4.78	0.53	4.96	0.51	4.49	0.52	9.82	0.89	10.25	0.63	9.04	0.77	6.69	0.40	6.73	0.38	6.70	0.67
Ireland	4.57	2.86	6.30	1.48	1.40	1.83							7.72	2.44	9.15	1.51	5.12	1.47
Italy	6.51	2.24	7.88	1.40	3.95	0.67							6.09	1.85	7.27	0.96	3.92	0.78
Netherlands	4.31	0.82	4.61	0.73	3.83	0.88							1.90	0.54	1.89	0.53	2.06	0.93
Portugal	5.62	2.53	7.94	2.10	3.20	0.86	9.68	3.03	11.11	2.76	6.99	0.83	5.87	2.56	7.28	2.14	3.24	0.80
Spain	4.41	1.72	5.42	1.16	2.60	0.88	7.49	2.05	8.70	1.37	5.28	0.85	3.57	1.54	4.50	0.96	1.91	0.88
Panel C. Spreads over money market rate																		
Austria	2.74	0.73	3.18	0.42	1.91	0.39	4.29	0.88	4.83	0.53	3.28	0.37	3.17	0.73	3.59	0.47	2.38	0.39
Belgium	2.37	0.54	2.43	0.58	2.24	0.44	4.17	1.14	4.52	1.26	3.52	0.35	0.95	0.15	0.94	0.13	0.95	0.18
Finland	2.12	0.56	2.45	0.39	1.51	0.20	3.32	0.63	3.66	0.48	2.67	0.23						
France	3.55	1.02	4.01	0.93	2.68	0.46	5.74	1.09	6.26	0.89	4.76	0.68	2.06	1.07	2.51	1.07	1.23	0.25
Germany	2.46	0.57	2.67	0.49	2.07	0.53	7.49	0.86	7.96	0.53	6.23	0.67	4.38	0.27	4.44	0.22	4.28	0.32
Ireland	1.38	0.62	1.38	0.47	1.39	0.84							4.54	0.56	4.24	0.40	5.11	0.32
Italy	3.03	0.82	3.43	0.65	2.28	0.52							2.62	0.56	2.82	0.48	2.24	0.49
Netherlands	2.78	0.62	3.07	0.48	2.22	0.46							0.39	0.19	0.35	0.19	0.45	0.19
Portugal	2.89	1.01	3.45	0.78	1.85	0.35	6.93	1.60	7.62	1.47	5.64	0.87	3.13	1.18	3.79	0.86	1.89	0.51
Spain	1.71	0.39	1.76	0.42	1.61	0.31	4.78	0.68	5.04	0.64	4.29	0.46	0.87	0.28	0.84	0.28	0.92	0.29

Note: "Stand. dev." indicates standard deviation. All rates are given in percentage points per annum. Blank cells indicate that the interest rate series is not available.

Table A2. Unit root tests

Panel A. Nominal lending rates

		Mortgage rates				Consumer rates				Corporate rates			
Country	Period	t(level)	F(level)	t(diff)	F(diff)	t(level)	F(level)	t(diff)	F(diff)	t(level)	F(level)	t(diff)	F(diff)
Austria	Full	-0.606	4.171	-3.219	5.223	-0.567	3.540	-4.253	9.046	0.155	6.384	-3.772	7.116
	Pre-EMU	-2.302	5.073	-3.387	5.750	-2.034	2.723	-4.216	8.898	-2.094	5.882	-3.657	6.723
	EMU	-4.388	11.739	-1.365	1.170	-4.234	12.752	-1.496	1.215	-2.669	6.104	-2.283	2.851
Belgium	Full	-1.667	5.885	-5.098	13.016	-2.203	5.395	-6.786	23.034	-2.686	7.015	-5.154	13.318
	Pre-EMU	-2.369	4.000	-4.184	8.762	-2.050	3.235	-5.603	15.714	-3.472	7.513	-4.466	9.995
	EMU	-1.934	1.875	-2.746	3.913	-2.541	3.321	-2.345	3.319	-2.615	3.532	-2.191	3.173
Finland	Full	-0.635	3.552	-4.152	8.620	-0.957	3.364	-6.740	22.721				
	Pre-EMU	-1.569	1.702	-3.038	4.620	-1.843	1.997	-5.730	16.422				
	EMU	-3.165	6.583	-2.781	4.339	-1.918	1.899	-1.172	2.788				
France	Full	0.611	2.156	-6.732	22.673	0.368	2.298	-7.197	25.919	-0.518	0.562	-5.761	16.595
	Pre-EMU	-4.606	11.670	-7.396	27.433	-2.704	3.951	-6.637	22.089	-5.805	17.901	-4.905	12.044
	EMU	-2.918	6.477	-4.107	8.444	-1.351	3.405	-4.927	12.172	-2.100	3.197	-3.993	8.008
Germany	Full	-2.319	4.070	-4.696	11.146	0.001	9.241	-6.606	21.906	0.236	13.546	-5.401	14.587
	Pre-EMU	-3.781	7.406	-4.203	8.882	-1.840	4.097	-6.060	18.413	-3.972	15.969	-6.184	19.136
	EMU	-1.316	1.389	-2.507	3.880	-1.601	6.632	-3.109	4.835	-1.693	4.161	-1.713	1.796
Ireland	Full	-1.431	1.542	-5.846	17.606					-1.353	1.596	-4.603	10.701
	Pre-EMU	-1.913	1.836	-5.067	13.268					-1.630	1.486	-3.780	7.155
	EMU	-1.228	2.723	-3.996	8.073					-2.302	7.016	-3.527	6.850
Italy	Full	-0.257	0.367	-5.082	13.251					-0.750	1.201	-3.231	6.228
	Pre-EMU	-2.389	10.881	-6.237	19.689					-3.887	9.707	-3.097	5.001
	EMU	-2.095	3.463	-3.218	6.572					-3.434	6.983	-1.638	3.128
Netherlands	Full	-2.214	5.260	-5.152	13.272					-0.991	5.740	-5.653	16.056
	Pre-EMU	-3.484	7.121	-4.610	10.678					-1.702	4.750	-3.571	6.460
	EMU	-2.596	3.379	-2.417	3.003					-1.899	3.755	-4.433	9.899
Portugal	Full	1.248	3.681	-2.981	4.716	-1.844	1.851	-7.461	27.834	0.064	1.777	-9.412	44.383
	Pre-EMU	-1.549	3.338	-4.213	8.953	-3.918	8.006	-6.243	19.502	-4.319	9.453	-8.997	40.694
	EMU	-2.329	8.753	-1.710	1.872	-3.329	5.796	-7.129	25.597	-1.965	3.452	-3.705	7.633
Spain	Full	0.242	4.107	-3.904	8.714	-0.514	0.775	-5.844	17.092	0.467	2.539	-5.349	14.385
	Pre-EMU	-1.709	1.474	-3.289	6.229	-3.215	6.092	-4.024	8.425	-1.736	1.545	-4.325	9.467
	EMU	-1.798	1.867	-1.315	2.351	-1.469	1.217	-5.657	18.438	-2.741	6.181	-3.740	7.300

Table A2 cont., Unit root tests
Panel B. Real lending rates

		Mortgage rates				Consumer rates				Corporate rates			
Country	Period	t(level)	F(level)	t(diff)	F(diff)	t(level)	F(level)	t(diff)	F(diff)	t(level)	F(level)	t(diff)	F(diff)
Austria	Full	-14.692	114.306	-6.668	22.231	-2.307	2.665	-7.457	27.821	-2.462	3.034	-8.421	35.457
	Pre-EMU	-18.732	186.695	-5.495	15.100	-2.422	3.150	-5.803	16.882	-2.541	3.562	-6.583	21.708
	EMU	-1.025	1.425	-5.691	16.288	-1.245	1.547	-5.272	13.936	-1.126	1.280	-5.442	14.885
Belgium	Full	-2.789	4.038	-5.714	16.337	-2.530	3.771	-5.806	16.895	-2.722	3.906	-6.357	20.219
	Pre-EMU	-2.066	2.662	-4.567	10.434	-1.714	2.495	-4.841	11.729	-2.402	3.580	-4.720	11.152
	EMU	-1.642	1.428	-3.476	6.090	-2.039	2.118	-3.274	5.364	-3.617	6.690	-4.821	11.624
Finland	Full	-1.894	1.954	-4.900	12.072	-2.055	2.270	-6.252	19.601				
	Pre-EMU	-1.526	1.276	-3.736	7.037	-1.833	1.742	-5.078	12.911				
	EMU	-1.652	2.869	-3.660	6.767	-1.438	2.004	-3.509	6.157				
France	Full	-3.871	7.498	-7.600	28.879	-3.315	5.495	-6.970	24.296	-3.306	5.464	-6.849	23.460
	Pre-EMU	-2.913	4.293	-5.539	15.339	-2.693	3.690	-5.649	15.956	-4.321	9.418	-5.101	13.013
	EMU	-3.320	6.435	-6.848	23.544	-2.642	3.559	-3.731	7.196	-2.418	3.639	-6.203	19.303
Germany	Full	-3.347	5.715	-6.136	18.827	-2.174	2.385	-6.731	22.673	-2.727	3.801	-7.342	26.965
	Pre-EMU	-2.482	3.693	-4.913	12.074	-1.173	1.492	-5.262	13.924	-1.529	2.400	-6.075	18.509
	EMU	-1.965	2.068	-3.521	6.204	-2.505	3.228	-4.292	9.309	-1.922	2.192	-4.436	9.913
Ireland	Full	-1.688	1.999	-5.516	15.211					-1.742	2.041	-5.635	15.887
	Pre-EMU	-1.575	1.247	-4.787	11.535					-1.521	1.179	-4.881	12.058
	EMU	-3.237	8.494	-3.874	7.504					-5.397	19.201	-3.384	5.727
Italy	Full	-1.198	0.783	-5.372	14.516					-1.310	0.986	-4.343	9.561
	Pre-EMU	0.094	2.239	-4.747	11.313					0.000	2.749	-4.332	9.383
	EMU	-1.006	1.654	-3.884	8.123					-1.107	8.092	-4.038	8.569
Netherlands	Full	-2.373	3.026	-6.175	19.085					-2.162	2.740	-6.595	21.751
	Pre-EMU	-3.477	6.171	-5.396	14.576					-1.908	2.160	-5.782	16.720
	EMU	-1.762	1.554	-2.964	4.407					-2.681	4.970	-3.274	5.406
Portugal	Full	-1.837	1.687	-4.769	11.374	-2.821	4.009	-7.050	24.852	-2.472	3.062	-7.152	25.615
	Pre-EMU	-1.778	3.383	-4.294	9.230	-3.156	5.668	-6.131	18.794	-3.140	5.946	-6.170	19.225
	EMU	-1.922	2.033	-4.192	8.841	-1.651	4.372	-7.830	30.797	-2.097	2.258	-4.019	8.146
Spain	Full	-3.298	5.491	-4.623	10.684	-3.992	8.241	-6.254	19.601	-2.877	4.282	-5.627	15.831
	Pre-EMU	-3.222	5.524	-3.855	7.436	-4.014	9.527	-4.870	12.431	-2.720	4.093	-4.445	9.888
	EMU	-2.898	6.963	-3.176	5.075	-1.568	1.884	-4.727	11.927	-3.100	7.279	-3.910	7.658

Table A2 cont., Unit root tests
Panel C. Lending rate spreads

		Mortgage rates				Consumer rates				Corporate rates			
Country	Period	t(level)	F(level)	t(diff)	F(diff)	t(level)	F(level)	t(diff)	F(diff)	t(level)	F(level)	t(diff)	F(diff)
Austria	Full	-3.251	5.413	-6.233	19.432	-3.834	7.365	-5.838	17.063	-3.480	6.095	-5.490	15.103
	Pre-EMU	-2.479	3.094	-4.286	9.193	-3.127	4.914	-4.225	8.924	-2.695	3.664	-4.142	8.584
	EMU	-3.462	6.058	-4.431	10.050	-3.112	4.941	-4.068	8.632	-2.753	3.837	-3.343	5.816
Belgium	Full	-2.168	2.608	-7.827	31.057	-2.083	2.263	-7.229	26.172	-2.837	5.165	-9.978	51.292
	Pre-EMU	-3.615	7.501	-7.541	28.987	-2.376	2.869	-5.880	17.330	-2.013	3.835	-11.149	64.436
	EMU	-1.296	1.823	-2.786	4.054	-1.215	2.239	-4.032	8.137	-1.376	1.852	-3.881	7.634
Finland	Full	-2.824	4.213	-7.233	26.161	-3.265	5.519	-9.384	44.052				
	Pre-EMU	-1.780	2.683	-5.033	12.692	-2.136	2.858	-7.981	31.874				
	EMU	-3.580	6.423	-5.107	13.071	-3.359	6.765	-4.981	12.716				
France	Full	-3.464	10.135	-8.577	38.118	-3.461	8.834	-7.902	32.226	-3.951	11.286	-9.736	48.279
	Pre-EMU	-2.258	7.006	-7.468	29.581	-2.383	5.905	-6.852	24.709	-3.205	14.229	-9.734	48.718
	EMU	-2.404	3.050	-3.974	8.281	-2.808	4.231	-3.208	5.458	-2.896	4.264	-4.302	9.378
Germany	Full	-2.717	3.705	-5.642	15.917	-2.356	3.115	-6.437	20.974	-2.478	3.088	-6.559	21.630
	Pre-EMU	-2.092	2.221	-4.626	10.759	-2.255	2.620	-5.094	13.426	-1.623	1.329	-5.030	13.003
	EMU	-1.320	1.717	-3.940	7.764	-2.196	2.411	-3.479	6.858	-2.316	2.692	-3.749	7.420
Ireland	Full	-2.057	2.175	-5.624	15.830					-1.716	1.481	-7.144	25.589
	Pre-EMU	-0.066	0.794	-4.867	11.865					-0.450	0.668	-5.729	16.445
	EMU	-1.549	1.729	-3.692	7.134					-2.220	2.483	-4.507	10.665
Italy	Full	-2.759	5.275	-10.546	55.969					-3.684	9.662	-10.317	53.869
	Pre-EMU	-2.037	3.120	-9.096	41.673					-3.380	6.897	-8.887	40.356
	EMU	-4.471	10.133	-4.331	9.522					-1.255	2.143	-4.851	12.402
Netherlands	Full	-2.511	3.382	-5.742	16.500					-3.640	6.833	-8.508	36.204
	Pre-EMU	-2.206	2.584	-4.168	8.836					-2.525	3.207	-5.988	17.938
	EMU	-1.220	0.889	-3.645	6.973					-2.414	3.748	-5.980	18.396
Portugal	Full	-2.734	4.099	-8.429	35.787	-3.971	8.143	-8.048	32.412	-5.686	16.232	-12.529	79.107
	Pre-EMU	-2.400	5.142	-7.753	30.560	-3.876	7.891	-6.421	20.629	-4.774	11.475	-10.641	57.379
	EMU	-1.133	1.355	-4.331	9.986	-3.040	6.292	-6.654	22.146	-2.970	4.546	-4.807	11.557
Spain	Full	-3.100	5.017	-7.070	24.996	-3.146	4.980	-8.021	32.358	-3.255	5.341	-8.213	33.730
	Pre-EMU	-2.159	3.392	-5.244	13.846	-2.630	3.465	-5.990	18.419	-0.701	1.953	-6.534	21.422
	EMU	-2.949	4.638	-5.215	14.655	-3.885	7.946	-4.976	12.612	-3.418	5.995	-5.072	13.045

Note: t(level) and F(level) give unit-root test-statistics for the level regression of equation (2.1) whereas t(diff) and F(diff) give the unit-root test-statistics for the regression in first differences of equation (2.2). The critical values for 100 observations are as follows: -3.46 (1%), -2.88 (5%), -2.57 (10%) for the t test and -8.73 (1%), 6.49 (5%), 5.47 (10%) for the F test. Blank cells indicate that the interest rate series is not available.

Table A3. Co-integration of lending rates

Panel A. Mortgage lending rates

Country	Period	Nominal lending rates							Real lending rates						
		Cointegrating vector (t-statistics)	DW	DF	ADF (k)	ECM			Cointegrating vector (t-statistics)	DW	DF	ADF(k)	ECM		
						ECT (t-stat.)	AIC	No. of lags					ECT (t-stat.)	AIC	No. of lags
Austria	Full	L_{AUS} = 2.55 + 0.52 L_{EU} (14.77) (21.93)	0.123	-1.724	-2.455 (2)				L_{AUS} = 2.96 + 0.37 L_{EU} (11.74) (7.97)	0.427	-2.798	-2.120 (1)	-0.224 (-2.772)	104.61	1
	Pre-EMU	L_{AUS} = 2.90 + 0.48 L_{EU} (10.99) (14.32)	0.127	-2.210	-2.481 (2)				L_{AUS} = 4.73 + 0.08 L_{EU} (11.98) (1.19)	0.748	-3.249		-0.416 (-3.286)	41.61	1
	EMU	L_{AUS} = 0.54 + 0.86 L_{EU} (1.15) (10.69)	0.213	-1.693	-1.723 (3)				L_{AUS} = -1.09 + 1.33 L_{EU} (-0.58) (2.92)	0.393	-1.618	-3.494 (2,3)	-0.355 (-2.792)	5.43	4
Belgium	Full	L_{BEL} = 3.22 + 0.39 L_{EU} (8.48) (7.50)	0.082	-1.431					L_{BEL} = 1.77 + 0.50 L_{EU} (4.01) (6.11)	0.194	-2.372	-3.021 (1)			
	Pre-EMU	L_{BEL} = 1.42 + 0.58 L_{EU} (3.42) (11.34)	0.190	-2.599					L_{BEL} = 0.59 + 0.69 L_{EU} (0.56) (3.89)	0.171	-1.872				
	EMU	L_{BEL} = -2.17 + 1.38 L_{EU} (-3.47) (13.01)	0.285	-1.700					L_{BEL} = -0.72 + 1.13 L_{EU} (-0.32) (2.06)	0.282	-1.314				
Finland	Full	L_{FIN} = 0.82 + 0.72 L_{EU} (2.76) (17.58)	0.066	-0.957	-2.431 (4)				L_{FIN} = -2.47 + 1.31 L_{EU} (-5.10) (14.68)	0.193	-1.868	-2.238 (3)			
	Pre-EMU	L_{FIN} = 0.27 + 0.78 L_{EU} (0.56) (12.67)	0.050	-1.097	-2.680 (2,3)				L_{FIN} = -4.45 + 1.64 L_{EU} (-3.70) (8.11)	0.218	-1.403				
	EMU	L_{FIN} = -2.20 + 1.26 L_{EU} (-4.40) (14.81)	0.501	-1.826					L_{FIN} = -3.01 + 1.48 L_{EU} (-1.88) (3.78)	0.458	-2.266		-0.350 (-2.226)	9.51	0
France	Full	L_{FRA} = 1.50 + 0.84 L_{EU} (15.73) (64.08)	0.768	-4.022	-5.536 (1,3)	-0.468 (-4.865)	-23.18	3	L_{FRA} = 1.92 + 0.79 L_{EU} (9.41) (20.93)	0.384	-3.005	-3.709 (3)	-0.264 (-2.769)	97.49	0
	Pre-EMU	L_{FRA} = 1.68 + 0.82 L_{EU} (12.26) (47.04)	0.947	-3.509	-5.083 (1,3)	-0.337 (-3.002)	-34.91	1	L_{FRA} = 2.12 + 0.76 L_{EU} (4.25) (9.11)	0.391	-2.379	-2.986 (3)	-0.379 (-2.895)	46.79	1
	EMU	L_{FRA} = 1.88 + 0.76 L_{EU} (5.32) (12.72)	0.618	-2.149	-2.242 (3)	-0.959 (-4.939)	-32.22	3	L_{FRA} = -0.51 + 1.39 L_{EU} (-0.60) (6.67)	0.494	-1.707		-0.017 (-0.067)	5.27	0
Germany	Full	L_{GER} = 3.59 + 0.32 L_{EU} (13.24) (9.18)	0.094	-1.768	-2.081 (1)				L_{GER} = 3.40 + 0.25 L_{EU} (15.23) (6.36)	0.329	-2.640	-2.937 (3)	-0.184 (-2.500)	99.57	0
	Pre-EMU	L_{GER} = 2.40 + 0.44 L_{EU} (10.10) (16.06)	0.259	-3.286	-2.864 (1)	-0.197 (-2.909)	-20.73	3	L_{GER} = 2.93 + 0.32 L_{EU} (5.47) (3.79)	0.217	-1.964				
	EMU	L_{GER} = -1.33 + 1.20 L_{EU} (-1.10) (5.90)	0.134	-1.843					L_{GER} = 3.55 + 0.22 L_{EU} (2.42) (0.59)	0.647	-1.806	-2.636 (3)	-0.318 (-1.694)	19.40	0
Ireland	Full	L_{IRE} = 2.49 + 0.55 L_{EU} (4.73) (7.63)	0.073	-1.126	-1.623 (1)				L_{IRE} = -5.92 + 1.98 L_{EU} (-4.51) (8.14)	0.209	-1.922				
	Pre-EMU	L_{IRE} = 6.26 + 0.12 L_{EU} (14.55) (2.13)	0.186	-0.965	-2.264 (1)				L_{IRE} = 7.80 - 0.25 L_{EU} (3.86) (-0.75)	0.354	-2.047	-2.327 (3)			
	EMU	L_{IRE} = 3.54 + 0.26 L_{EU} (2.50) (1.08)	0.214	-1.064					L_{IRE} = -13.18 + 3.50 L_{EU} (-2.00) (2.19)	0.279	-1.355	-2.651 (3)			
Italy	Full	L_{ITA} = -8.72 + 2.72 L_{EU} (-8.02) (16.77)	0.051	-0.823	-0.686 (3)				L_{ITA} = -4.78 + 2.25 L_{EU} (-4.69) (11.23)	0.116	-1.765	-2.235 (3)			
	Pre-EMU	L_{ITA} = -5.14 + 2.30 L_{EU} (-5.79) (18.46)	0.143	-2.572					L_{ITA} = 2.08 + 1.06 L_{EU} (1.19) (3.34)	0.067	0.230	-0.494 (3)			
	EMU	L_{ITA} = 2.75 + 0.55 L_{EU} (4.49) (5.26)	0.251	-1.891	-1.863 (3)				L_{ITA} = 3.30 + 0.13 L_{EU} (1.99) (0.33)	0.292	-2.187				

Table A3 cont., Co-integration of lending rates

Panel A. Mortgage lending rates

Country	Period	Nominal lending rates							Real lending rates						
		Cointegrating vector (t-statistics)	DW	DF	ADF (k)	ECM			Cointegrating vector (t-statistics)	DW	DF	ADF(k)	ECM		
						ECT (t-stat.)	AIC	No. of lags					ECT (t-stat.)	AIC	No. of lags
Nether-lands	Full	L_{NET} = 3.60 + 0.35 L_{EU} (14.37) (10.44)	0.108	-1.855	-2.109 (1, 4)				L_{NET} = 1.31 + 0.55 L_{EU} (3.70) (8.56)	0.283	-2.339	-2.829 (3)			
	Pre-EMU	L_{NET} = 2.84 + 0.43 L_{EU} (10.57) (13.06)	0.240	-3.376	-2.852 (1,4)	-0.198 (-2.759)	-8.14	0	L_{NET} = -1.37 + 0.98 L_{EU} (-2.83) (12.40)	0.591	-2.656		-0.216 (-1.392)	72.40	1
	EMU	L_{NET} = -1.08 + 1.19 L_{EU} (-1.91) (12.39)	0.210	-1.285	-1.844 (3)				L_{NET} = 8.88 - 1.25 L_{EU} (4.09) (-2.38)	0.424	-1.449	-2.223 (3)	-0.372 (-3.451)	7.56	2
Portugal	Full	L_{POR} = -5.98 + 2.02 L_{EU} (-14.36) (35.08)	0.110	-1.644					L_{POR} = -6.83 + 2.35 L_{EU} (-11.38) (21.12)	0.290	-2.223	-2.353 (3)			
	Pre-EMU	L_{POR} = -4.70 + 1.88 L_{EU} (-6.81) (27.02)	0.123	-1.542	-1.758 (1)				L_{POR} = -10.95 + 3.03 L_{EU} (-8.36) (13.73)	0.337	-2.213	-2.299 (2)	-0.063 (-0.991)	81.87	3
	EMU	L_{POR} = -0.84 + 1.08 L_{EU} (-0.90) (6.84)	0.171	-0.747	-0.564 (2)				L_{POR} = 4.74 - 0.41 L_{EU} (3.24) (-1.17)	0.405	-1.595		-0.252 (-1.922)	0.71	0
Spain	Full	L_{SPA} = -5.09 + 1.73 L_{EU} (-13.43) (33.05)	0.111	-1.357	-2.082 (2)				L_{SPA} = -4.82 + 1.71 L_{EU} (-14.40) (27.99)	0.416	-3.026	-3.302 (3)	-0.140 (-2.500)	82.02	3
	Pre-EMU	L_{SPA} = -6.71 + 1.93 L_{EU} (11.59) (26.14)	0.138	-0.473	-1.349 (2)				L_{SPA} = -4.75 + 1.70 L_{EU} (-6.00) (12.89)	0.348	-2.319		-0.141 (-1.967)	47.36	2
	EMU	L_{SPA} = -0.76 + 1.02 L_{EU} (1.12) (8.90)	-0.686						L_{SPA} = -0.78 + 0.76 L_{EU} (-0.53) (2.17)	0.338	-3.911	-1.820 (3)	-0.359 (-4.007)	-19.26	1

Table A3 cont., Co-integration of lending rates

Panel B. Consumer lending rates

Country	Period	Nominal lending rates								Real lending rates							
		Cointegrating vector (t-statistics)	DW	DF	ADF (k)	ECM			Cointegrating vector (t-statistics)	DW	DF	ADF (k)	ECM				
						ECT (t-stat.)	AIC	No of lags					ECT (t-stat.)	AIC	No of lags		
Austria	Full	L_{AUS} = 0.89 + 0.67 L_{EU} (3.13) (25.57)	0.157	-1.827	-1.804 (3)				L_{AUS} = 1.86 + 0.53 L_{EU} (5.95) (14.84)	0.601	-3.442		-0.241 (-2.617)	99.42	0		
	Pre-EMU	L_{AUS} = 1.70 + 0.60 L_{EU} (4.79) (18.74)	0.231	-2.793					L_{AUS} = 3.82 + 0.32 L_{EU} (6.99) (5.57)	0.678	-3.115		-0.297 (-2.538)	44.31	0		
	EMU	L_{AUS} = -9.31 + 1.79 L_{EU} (-13.92) (24.34)	1.126	-2.936		-0.195 (-0.935)	-41.99	3	L_{AUS} = -0.07 + 0.77 L_{EU} (-0.10) (8.09)	1.119	-2.835	-3.051 (3,4)	-0.613 (-2.597)	8.88	0		
Belgium	Full	L_{BEL} = -1.23 + 0.88 L_{EU} (-1.48) (10.97)	0.230	-2.804					L_{BEL} = -3.40 + 1.10 L_{EU} (-3.54) (10.12)	0.263	-2.972						
	Pre-EMU	L_{BEL} = -4.58 + 0.16 L_{EU} (-3.71) (10.41)	0.331	-2.547					L_{BEL} = -9.21 + 1.70 L_{EU} (-4.63) (8.07)	0.380	-2.575						
	EMU	L_{BEL} = -9.24 + 1.80 L_{EU} (-3.42) (6.09)	0.274	-2.398					L_{BEL} = 0.40 + 0.63 L_{EU} (0.35) (4.25)	0.385	-1.511						
Finland	Full	L_{FIN} = 1.14 + 0.81 L_{EU} (-2.54) (18.59)	0.463	-3.047		-0.161 (-1.924)	136.85	0	L_{FIN} = -9.68 + 1.74 L_{EU} (-12.55) (23.41)	0.582	-3.163		-0.197 (-2.132)	158.41	0		
	Pre-EMU	L_{FIN} = -1.95 + 0.87 L_{EU} (-3.14) (15.42)	0.737	-3.325		-0.312 (-2.587)	80.89	0	L_{FIN} = -9.46 + 1.71 L_{EU} (-11.12) (18.79)	1.091	-4.005	-4.163 (1)	-0.531 (-2.647)	99.32	5		
	EMU	L_{FIN} = -13.95 + 2.23 L_{EU} (-11.54) (16.80)	0.696	-2.361		0.225 (1.195)	-17.07	1	L_{FIN} = -0.98 + 0.69 L_{EU} (-1.07) (5.70)	0.587	-2.630		-0.511 (-2.751)	8.81	0		
France	Full	L_{FRA} = -0.06 + 0.95 L_{EU} (-0.37) (55.52)	0.451	-3.149	-3.668 (3)	-0.368 (-4.237)	2.32	1	L_{FRA} = 0.69 + 0.88 L_{EU} (3.14) (34.86)	0.579	-3.542	-3.983 (3)	-0.309 (-2.150)	109.88	0		
	Pre-EMU	L_{FRA} = 0.48 + 0.91 L_{EU} (1.76) (36.04)	0.549	-2.760	-3.243 (3)	-0.374 (-3.091)	7.19	0	L_{FRA} = 0.90 + 0.86 L_{EU} (1.87) (16.58)	0.576	-2.908	-3.289 (3)	-0.342 (-2.011)	63.60	0		
	EMU	L_{FRA} = 2.16 + 0.70 L_{EU} (6.50) (18.87)	1.195	-3.010	-3.666 (2,3,4)	-0.757 (-3.469)	-57.97	1	L_{FRA} = -0.15 + 1.00 L_{EU} (-0.41) (19.99)	0.837	-3.173	-2.628 (2)	-0.751 (-1.065)	5.50	6		
Germany	Full	L_{GER} = 6.19 + 0.51 L_{EU} (58.03) (46.41)	0.375	-3.733		-0.112 (-1.587)	-47.89	1	L_{GER} = 5.26 + 0.59 L_{EU} (17.86) (15.69)	0.295	-2.139						
	Pre-EMU	L_{GER} = 6.16 + 0.51 L_{EU} (35.01) (30.38)	0.358	-3.204		-0.068 (-0.877)	-49.38	2	L_{GER} = 5.84 + 0. 52 L_{EU} (11.42) (8.68)	0.301	-1.447						
	EMU	L_{GER} = 5.68 + 0.57 L_{EU} (11.27) (9.19)	0.416	-1.044		-0.317 (-2.684)	-63.21	2	L_{GER} = -0.26 + 1.47 L_{EU} (-0.328) (11.17)	0.709	-2.184		-0.563 (-2.418)	12.58	1		
Portugal	Full	L_{POR} = -12.98 + 2.51 L_{EU} (-12.53) (24.69)	0.638	-3.550	-2.637 (1)	-0.341 (-3.931)	250.60	0	L_{POR} = -10.02 + 2.29 L_{EU} (-5.78) (11.46)	0.325	-2.432	-1.890 (1)					
	Pre-EMU	L_{POR} = -11.75 + 2.41 L_{EU} (-7.31) (16.15)	0.604	-2.898		-0.309 (-2.948)	150.42	0	L_{POR} = -13.52 + 2.68 L_{EU} (-3.79) (6.93)	0.273	-1.430						
	EMU	L_{POR} = 6.35 + 0.33 L_{EU} (2.26) (1.06)	2.590	-6.471	-6.277 (3)	-1.479 (-6.848)	38.73	3	L_{POR} = 6.49 + 0.05 L_{EU} (3.06) (0.19)	1.216	-2.999		-0.256 (-1.034)	53.23	2		
Spain	Full	L_{SPA} = -13.27 + 2.32 L_{EU} (-21.39) (38.21)	0.373	-3.444	-3.134 (3)	-0.306 (-4.253)	133.17	1	L_{SPA} = -8.62 + 1.83 L_{EU} (-8.51) (16.00)	0.226	-2.435						
	Pre-EMU	L_{SPA} = -13.26 + 2.32 L_{EU} (-12.54) (23.55)	0.292	-2.570	-2.253 (3)				L_{SPA} = -5.23 + 1.49 L_{EU} (-3.19) (8.52)	0.255	-1.538						
	EMU	L_{SPA} = -10.20 + 1.98 L_{EU} (-5.35) (9.54)	0.730	-2.349		-0.329 (-1.645)	8.07	0	L_{SPA} = 1.23 + 0.50 L_{EU} (0.98) (3.12)	0.367	-3.540	-2.767 (1)	-0.334 (-3.055)	2.59	1		

Table A3 cont., Co-integration of lending rates

Panel C. Corporate lending rates

Country	Period	Nominal lending rates							Real lending rates						
		Cointegrating vector (t-statistics)	DW	DF	ADF(k)	ECM			Cointegrating vector (t-statistics)	DW	DF	ADF(k)	ECM		
						ECT (t-stat.)	AIC	No. of lags					ECT (t-stat.)	AIC	No. of lags
Austria	Full	L_{AUS} = 2.28 + 0.63 L_{EU} (18.80) (37.13)	0.184	-2.375	-2.281 (2)				L_{AUS} = 2.74 + 0.51 L_{EU} (10.56) (10.19)	0.634	-3.498	-1.866 (1,2)	-0.336 (-3.676)	100.20	0
	Pre-EMU	L_{AUS} = 2.43 + 0.61 L_{EU} (12.08) (23.28)	0.142	-2.320					L_{AUS} = 4.03 + 0.28 L_{EU} (8.49) (3.36)	0.894	-3.533	-3.163 (2)	-0.422 (-3.264)	41.58	0
	EMU	L_{AUS} = 1.33 + 0.79 L_{EU} (8.41) (30.20)	0.906	-3.280	-3.814 (2)	-0.669 (-2.639)	-33.46	2	L_{AUS} = -0.91 + 1.38 L_{EU} (-0.82) (5.14)	0.700	-2.059		-0.738 (-3.293)	6.06	2
Belgium	Full	L_{BEL} = 3.19 + 0.20 L_{EU} (7.47) (3.35)	0.088	-1.654	-2.057 (1,3)				L_{BEL} = 1.46 + 0.29 L_{EU} (2.96) (3.13)	0.209	-2.412	-1.910 (1,4)			
	Pre-EMU	L_{BEL} = 3.18 + 0.18 L_{EU} (6.48) (2.88)	0.142	-3.568		-0.168 (-3.381)	2.82	0	L_{BEL} = 3.31 - 0.02 L_{EU} (2.60) (-0.09)	0.168	-2.156	-2.346 (1)			
	EMU	L_{BEL} = -3.08 + 1.28 L_{EU} (-4.75) (11.95)	0.304	-1.559					L_{BEL} = 1.75 + 0.20 L_{EU} (1.73) (0.84)	0.963	-2.427		-0.531 (-3.086)	8.30	2
France	Full	L_{FRA} = -3.14 + 1.26 L_{EU} (-9.82) (28.84)	0.312	-2.430					L_{FRA} = -1.59 + 1.18 L_{EU} (-3.11) (12.28)	0.204	-2.960	-2.699 (3)			
	Pre-EMU	L_{FRA} = -4.95 + 1.47 L_{EU} (-10.68) (25.02)	0.389	-2.079	-2.844 (3)	-0.212 (-0.268)	24.10	2	L_{FRA} = -9.69 + 2.56 L_{EU} (-7.92) (12.14)	0.574	-3.457		-0.186 (-1.991)	66.83	0
	EMU	L_{FRA} = -2.06 + 1.12 L_{EU} (-4.00) (13.56)	0.870	-2.602		-0.203 (-0.954)	10.38	0	L_{FRA} = 0.91 + 0.65 L_{EU} (1.44) (4.39)	1.467	-3.508		-0.667 (-2.192)	14.67	0
Germany	Full	L_{GER} = 6.84 + 0.17 L_{EU} (33.78) (5.61)	0.044	-1.576	-2.248 (2,3,4)				L_{GER} = 6.36 + 0.07 L_{EU} (31.75) (1.68)	0.386	-2.684		-0.204 (-2.738)	94.04	0
	Pre-EMU	L_{GER} = 6.17 + 0.24 L_{EU} (38.73) (11.30)	0.157	-2.890	-2.891 (1,3,4)				L_{GER} = 6.68 + 0. 01 L_{EU} (14.91) (0.12)	0.331	-1.705				
	EMU	L_{GER} = 3.31 + 0.90 L_{EU} (15.43) (21.88)	0.565	-2.331		-0.156 (-1.367)	-51.61	1	L_{GER} = 3.16 + 1.08 L_{EU} (3.38) (3.69)	0.484	-1.640		-0.596 (-2.799)	17.16	3
Ireland	Full	L_{IRE} = 6.50 + 0.44 L_{EU} (15.53) (7.49)	0.100	-1.256	-1.697 (1)				L_{IRE} = -2.75 + 2.04 L_{EU} (-1.96) (7.56)	0.243	-2.045				
	Pre-EMU	L_{IRE} = 9.32 + 0.09 L_{EU} (18.16) (1.40)	0.212	-0.693	-1.907 (1)				L_{IRE} = 11.75 - 0.46 L_{EU} (4.56) (-1.01)	0.333	-1.982	-2.251 (3)			
	EMU	L_{IRE} = 3.10 + 0.96 L_{EU} (16.17) (29.81)	1.123	-3.113		-0.711 (-2.838)	-26.58	0	L_{IRE} = -1.39 + 1.51 L_{EU} (-0.42) (1.92)	0.174	-0.770	-2.232 (3,4)			
Italy	Full	L_{ITA} = -7.59 + 2.51 L_{EU} (-5.76) (12.62)	0.028	0.922	0.389 (2,3)				L_{ITA} = -3.90 + 2.03 L_{EU} (-3.23) (8.34)	0.113	-1.510				
	Pre-EMU	L_{ITA} = -4.23 + 2.14 L_{EU} (-4.93) (17.29)	0.086	-1.812	-1.040 (3)				L_{ITA} = 5.72 + 0.29L_{EU} (3.96) (1.07)	0.049	1.041	-0.063 (3)			
	EMU	L_{ITA} = 1.68 + 0.71 L_{EU} (3.92) (9.97)	0.233	-3.387		-0.453 (-4.944)	-33.38	0	L_{ITA} = -2.29 + 1.43 L_{EU} (-2.02) (5.36)	1.067	-2.876		-0.607 (-3.006)	-11.35	4
Nether-lands	Full	L_{NET} = 3.65 + 0.02 L_{EU} (8.03) (0.27)	0.054	0.257	-1.371 (3,4)				L_{NET} = 1.58 + 0.06 L_{EU} (3.87) (0.80)	0.354	-2.428				
	Pre-EMU	L_{NET} = 2.89 + 0.09 L_{EU} (5.77) (1.41)	0.060	-2.064					L_{NET} = -0.63 + 0.41 L_{EU} (-0.74) (2.95)	0.416	-2.036		-0.181 (-1.696)	73.03	0
	EMU	L_{NET} = -3.87 + 1.29 L_{EU} (-14.84) (30.83)	2.246	-5.370		-0.688 (-2.147)	-2.52	0	L_{NET} = 4.31 - 0.54 L_{EU} (2.58) (-1.44)	0.267	-0.958	-1.764 (4)			

Table A3 cont., Co-integration of lending rates

Panel C. Corporate lending rates

Country	Period	Nominal lending rates							Real lending rates						
		Cointegrating vector (t-statistics)	DW	DF	ADF(k)	ECM			Cointegrating vector (t-statistics)	DW	DF	ADF(k)	ECM		
						ECT (t-stat.)	AIC	No. of lags					ECT (t-stat.)	AIC	No. of lags
Portugal	Full	L_{POR} = -8.52 + 2.46 L_{EU} (-13.47) (27.43)	0.263	-1.189	0.871 (1,2)				L_{POR} = -9.88 + 3.07 L_{EU} (-10.90) (17.57)	0.364	-2.577	-3.095 (3)	-0.067 (-1.118)	206.10	0
	Pre-EMU	L_{POR} = -7.33 + 2.34 L_{EU} (-16.14) (39.03)	1.401	-4.788		-0.717 (-5.032)	86.33	0	L_{POR} = -15.82 + 4.12 L_{EU} (-8.22) (12.04)	0.504	-2.018	-2.396 (3)	-0.178 (-1.893)	126.06	1
	EMU	L_{POR} = 0.84 + 0.79 L_{EU} (1.57) (8.88)	0.731	-3.120		-0.452 (-3.581)	-9.42	3	L_{POR} = 4.98 - 0.45 L_{EU} (3.55) (-1.34)	0.715	-2.476		-0.416 (-2.612)	21.47	1
Spain	Full	L_{SPA} = -6.86 + 1.87 L_{EU} (-19.07) (37.29)	0.345	-2.187					L_{SPA} = -6.69 + 1.93 L_{EU} (-14.42) (22.323)	0.605	-4.032	-3.968 (3)	-0.217 (-2.7697)	140.80	1
	Pre-EMU	L_{SPA} = -8.02 + 2.03 L_{EU} (-16.63) (32.12)	0.354	-2.511					L_{SPA} = -5.28 + 1.69 L_{EU} (-4.76) (8.84)	0.406	-2.768		-0.241 (-3.064)	62.31	1
	EMU	L_{SPA} = -2.38 + 1.14 L_{EU} (5.47) (16.13)	2.103	-5.042		-0.979 (-3.622)	14.14	0	L_{SPA} = -2.56 + 0.97 L_{EU} (-2.65) (4.45)	2.117	-5.434		-0.960 (-3.757)	21.73	0

Note: For the cointegrating vector, L indicates lending rates and the subscripts indicate the country. EU indicates the average of all countries except the country under investigation. Furthermore, t-statistics are given in parentheses and the following test statistics are reported: Durbin Watson (DW), Dickey Fuller (DF), Augmented Dickey Fuller with optimal lag length selected by AIC criteria based on all models up to 4 lags (ADF(k_4)) or 12 lags (ADF(k_{12})). The critical values at the 1%, 5%, and 10% level for 100 observations are as follows: 0.511, 0.386, and 0.322 for DW, 4.07, 3.37, and 3.03 for DF, 3.77, 3.17, and 2.84 for ADF(k).

Table A4. Standard pass-through model

Country	Full period		Pre-EMU period		EMU period	
	Impact multiplier (t-statistic)	Long-run multiplier	Impact multiplier (t-statistic)	Long-run multiplier	Impact multiplier (t-statistic)	Long-run multiplier
Panel A. Mortgage rates						
Austria	0.139	0.722	0.064	0.563	0.073	0.609
	(2.411)		(0.752)		(0.933)	
Belgium	0.322	0.571	0.240	0.712	0.263	0.148
	(3.226)		(1.721)		(1.819)	
Finland	0.295	0.770	0.330	0.684	0.260	0.697
	(4.491)		(3.953)		(2.229)	
France	0.158	0.294	0.011	0.014	0.493	0.640
	(2.640)		(0.165)		(4.058)	
Germany	0.358	0.312	0.325	0.405	0.478	-0.916
	(2.995)		(1.824)		(2.339)	
Ireland	0.229	0.567	0.252	0.520	0.263	0.962
	(3.076)		(4.681)		(0.787)	
Italy	0.295	0.682	0.257	0.783	0.410	0.400
	(2.586)		(1.632)		(2.497)	
Netherlands	0.132	0.430	0.071	0.092	0.068	0.138
	(1.485)		(0.577)		(0.490)	
Portugal	0.163	1.027	0.174	0.468	-0.152	0.440
	(2.037)		(1.500)		(-1.521)	
Spain	0.152	0.657	0.126	0.530	0.113	0.512
	(3.984)		(2.882)		(1.565)	
Panel B. Consumer rates						
Austria	0.152	0.850	0.049	0.908	0.181	0.711
	(1.961)		(0.415)		(2.229)	
Belgium	0.790	1.014	0.980	1.321	0.251	-0.575
	(3.642)		(2.795)		(1.145)	
Finland	0.528	0.800	0.067	0.770	0.372	0.590
	(2.740)		(0.197)		(2.650)	
France	-0.007	0.192	-0.150	-0.144	0.063	0.236
	(-0.098)		(-1.582)		(0.813)	
Germany	0.166	0.494	0.140	0.412	0.141	0.405
	(2.703)		(1.376)		(2.592)	
Portugal	0.331	0.262	-0.485	-0.281	-0.121	-0.051
	(0.706)		(-0.598)		(-0.221)	
Spain	0.690	0.646	0.663	0.887	0.371	0.287
	(4.942)		(4.237)		(1.191)	
Panel C. Corporate rates						
Austria	0.245	0.736	0.129	0.513	0.349	0.779
	(4.697)		(1.978)		(3.910)	
Belgium	0.808	0.849	0.864	0.959	0.878	0.716
	(8.220)		(7.494)		(5.673)	
France	0.387	0.957	0.273	0.876	1.001	0.904
	2.836)		(1.445)		(4.662)	
Germany	0.099	0.631	0.167	0.373	0.086	0.669
	(1.476)		(1.611)		(1.540)	
Ireland	0.269	0.638	0.300	0.764	0.074	0.532
	(5.077)		(4.778)		(0.666)	
Italy	0.150	0.850	0.126	0.843	0.165	0.875
	(4.230)		(2.760)		(2.052)	
Netherlands	0.308	0.900	0.167	0.772	0.333	1.029
	(3.939)		(1.548)		(2.544)	
Portugal	0.416	0.950	0.127	0.279	0.271	0.766
	(1.856)		(0.317)		(1.034)	
Spain	0.521	0.842	0.592	0.663	0.192	0.794
	(4.911)		(5.645)		(0.626)	

Table A5. Pass-through model selection

Panel A. Mortgage lending rates

Country	Period	AIC values at optimal lag length					Cointegration based on best TAR					Engle-Granger cointegration			Selected pass-through model
		TAR^0	TAR*	BTAR	$MTAR^0$	MTAR*	Coint. test: H_0: $\sum_i \tilde{n}_i = 0$	Asymmetry tests			Cointe-gration?	DW	DF	Cointegration?	
								H_0: $\tilde{n}_1=\tilde{n}_2$	H_0: $\tilde{n}_1=\tilde{n}_3$	H_0: $\tilde{n}_2=\tilde{n}_3$					
Austria	Full	-8.809	-10.693	**-13.714**	-6.684	-9.412	4.315	7.673	0.155	6.075	no	0.027	-1.603	no	STD
	Pre-EMU	18.091	14.324	**11.666**	19.284	15.406	4.183	9.324	3.000	4.966	no	0.195	-1.276	no	STD
	EMU	-37.148	-37.493	**-54.685**	-36.784	-37.180	15.540	26.829	0.068	26.756	yes, asym.	0.688	-3.046	yes	BTAR
Belgium	Full	69.602	65.195	**62.956**	68.304	63.725	4.220	8.656	0.069	8.678	no	0.137	-1.677	no	STD
	Pre-EMU	38.830	36.056	33.647	38.097	**32.660**	3.429	5.579			no	0.156	-1.074	no	STD
	EMU	-13.638	-14.157	-13.383	-14.794	**-22.168**	9.982	9.965			yes, asym.	0.175	-1.521	no	MTAR*
Finland	Full	25.784	23.949	21.261	25.040	**19.461**	3.121	5.734			no	0.065	-0.643	no	STD
	Pre-EMU	-15.419	-15.880	**-35.379**	-14.563	-18.739	9.707	26.536	2.588	26.420	yes, asym.	0.098	-0.196	no	BTAR
	EMU	-24.429	-26.982	**-27.663**	-23.533	-24.347	8.243	4.554	0.032	5.249	yes, asym.	1.645	-4.055	yes	BTAR
France	Full	46.003	45.348	44.490	46.194	**29.784**	8.983	17.461			yes, asym.	0.041	-0.433	yes	MTAR*
	Pre-EMU	15.998	15.389	14.995	16.838	**4.885**	6.184	12.064			yes, asym.	0.073	-0.254	no	MTAR*
	EMU	-26.447	-26.763	-27.158	-26.087	**-28.445**	6.321	2.860			yes, asym.	1.111	-2.979	yes	MTAR*
Germany	Full	27.187	26.675	24.093	28.065	**19.037**	6.067	9.259			yes, asym.	0.087	-1.322	no	MTAR*
	Pre-EMU	4.736	3.519	3.372	5.604	**-4.700**	5.693	10.859			no	0.107	-0.335	no	STD
	EMU	-13.282	-16.399	**-17.221**	-15.115	-16.691	4.353	3.763	0.047	3.108	no	0.166	-1.556	no	STD
Ireland	Full	97.561	95.199	93.048	97.244	**89.462**	6.620	8.875			yes, asym.	0.210	-1.946	no	MTAR*
	Pre-EMU	4.796	0.401	**-7.876**	5.574	-4.633	8.474	13.848	0.057	9.667	yes, asym.	0.321	-2.293	no	BTAR
	EMU	14.958	14.168	**10.908**	14.098	13.127	2.971	5.698	0.384	4.901	no	0.236	-1.341	no	STD
Italy	Full	114.715	114.143	**108.481**	115.318	112.580	3.063	7.911	0.891	7.397	no	0.220	-2.329	no	STD
	Pre-EMU	60.029	55.139	**52.176**	59.219	58.592	3.628	6.553	0.799	8.862	no	0.324	-2.706	(no)	SYM
	EMU	-19.533	-20.647	**-20.762**	-20.072	-20.148	3.467	3.094	0.135	2.912	no	0.516	-2.623	yes	SYM
Nether-	Full	48.618	48.111	48.706	47.110	**46.051**	2.297	1.463			no	0.098	-2.138	no	STD
lands	Pre-EMU	31.289	30.688	30.772	29.516	**24.529**	3.716	5.580			no	0.196	-1.519	no	STD
	EMU	-10.401	-11.807	**-17.932**	-11.363	-15.300	5.203	9.730	0.007	9.755	no	0.222	-1.387	no	STD
Portugal	Full	93.748	93.156	**88.771**	92.702	89.870	3.558	6.566	0.181	6.511	no	0.158	-1.843	no	STD
	Pre-EMU	29.632	27.846	27.266	29.520	**24.414**	5.031	4.743			no	0.166	-1.866	no	STD
	EMU	-5.387	-6.051	**-7.709**	-5.496	-7.349	2.543	4.135	0.021	4.082	no	0.440	-1.784	yes	SYM
Spain	Full	83.431	81.636	80.325	83.275	**79.410**	5.768	3.899			no	0.485	-3.515	yes	SYM
	Pre-EMU	45.312	43.086	**40.946**	45.256	43.206	5.152	5.458	0.574	6.158	no	0.785	-3.209	yes	SYM
	EMU	-21.138	-21.342	**-23.877**	-20.252	-21.167	3.206	4.420	0.014	4.458	no	0.649	-2.091	yes	SYM

Table A5 cont., Pass-through model selection

Panel B. Consumer lending rates

Country	Period	AIC values at optimal lag length					Cointegration based on best TAR					Engle-Granger cointegration			Selected pass-through
		TAR^0	TAR*	BTAR	$MTAR^0$	MTAR*	Coint. test: H_0: $\Sigma_i \tilde{n}_i = 0$	Asymmetry tests H_0: $\tilde{n}_1=\tilde{n}_2$	H_0: $\tilde{n}_1=\tilde{n}_3$	H_0: $\tilde{n}_2=\tilde{n}_3$	Cointe-gration?	DW	DF	Cointegration?	model
Austria	Full	25.013	23.382	**22.656**	28.219	25.687	3.904	6.906	0.082	4.899	no	0.030	-1.696	no	STD
	Pre-EMU	41.087	39.837	39.437	41.817	**38.164**	1.995	3.637			no	0.253	-1.435	no	STD
	EMU	-36.152	-37.198	-35.885	-34.210	**-37.113**	5.744	1.197			no	0.644	-3.194	yes	SYM
Belgium	Full	143.262	143.087	144.219	142.597	**101.126**	36.024	66.933			yes, asym.	0.121	-1.511	no	MTAR*
	Pre-EMU	89.256	87.285	86.167	89.959	**82.737**	3.931	6.999			no	0.248	-1.629	no	STD
	EMU	-15.187	-15.506	-18.248	-14.556	**-19.277**	4.965	4.928			no	0.405	-2.072	yes	SYM
Finland	Full	103.011	98.483	99.914	101.569	**94.534**	5.252	10.496			no	0.255	-1.810	no	STD
	Pre-EMU	59.790	54.981	55.216	58.911	**49.056**	6.008	12.008			yes, asym.	0.617	-2.438	yes	MTAR*
	EMU	-25.893	-29.679	**-30.067**	-26.211	-27.164	6.815	4.921	0.253	6.634	yes, asym.	1.318	-3.377	yes	BTAR
France	Full	74.754	73.603	74.372	73.470	**61.647**	7.451	14.546			yes, asym.	0.048	-0.331	no	MTAR*
	Pre-EMU	40.386	39.082	38.453	42.472	**31.068**	5.775	11.461			no	0.110	-0.522	yes	SYM
	EMU	-43.426	-44.449	-43.006	-47.796	**-47.796**	10.988	14.123			yes, asym.	0.713	-2.199	yes	MTAR*
Germany	Full	-37.577	-37.823	**-37.961**	-31.338	-33.914	4.426	2.629	9.072	1.936	no	0.014	-1.621	no	STD
	Pre-EMU	6.206	3.030	1.929	3.259	**1.225**	2.737	4.935			no	0.095	-0.736	no	STD
	EMU	-57.282	**-62.758**	-61.294	-56.414	-59.177	4.464	6.455			no	0.266	-1.252	no	STD
Portugal	Full	247.188	246.237	244.963	247.955	**244.056**	2.944	3.693			no	0.609	-3.198	yes	SYM
	Pre-EMU	139.137	137.954	**136.794**	139.043	138.572	3.047	3.697	0.001	3.774	no	0.966	-3.933	yes	SYM
	EMU	31.387	26.801	**26.988**	31.324	31.052	7.412	3.930			yes, asym.	2.663	-6.715	yes	BTAR
Spain	Full	122.670	120.611	**118.764**	123.777	120.999	3.121	6.495	1.459	3.531	no	0.428	-2.522	yes	SYM
	Pre-EMU	53.491	50.555	**47.809**	53.359	49.841	3.462	4.158	0.701	6.717	no	0.583	-2.722	yes	SYM
	EMU	4.309	3.708	**-4.718**	3.200	1.044	9.257	11.714	0.009	11.714	yes, asym.	0.756	-2.971	yes	BTAR

Table A5 cont., Pass-through model selection

Panel C. Corporate lending rates

Country	Period	AIC values at optimal lag length					Cointegration based on best TAR					Engle-Granger cointegration			Selected pass-through model
		TAR^0	TAR*	BTAR	$MTAR^0$	MTAR*	Coint. test: H_0: $\sum_i \tilde{n}_i = 0$	Asymmetry tests			Cointe-gration?	DW	DF	Cointe-gration?	
								H_0: $\tilde{n}_1=\tilde{n}_2$	H_0: $\tilde{n}_1=\tilde{n}_3$	H_0: $\tilde{n}_2=\tilde{n}_3$					
Austria	Full	-23.950	-23.970	**-28.576**	-21.840	-22.188	4.847	9.675	0.019	6.325	no	0.022	-1.624	no	STD
	Pre-EMU	16.502	11.820	**9.505**	17.367	12.852	4.173	10.043	3.628	4.225	no	0.156	-1.017	no	STD
	EMU	-38.548	-39.216	-38.351	-37.247	**-38.589**	3.207	0.619			no	0.508	-2.428	yes	SYM
Belgium	Full	-9.587	-13.745	-14.346	-11.089	**-15.119**	7.398	5.804			yes, asym.	0.890	-4.332	yes	MTAR*
	Pre-EMU	-31.691	-33.068	-33.352	-35.647	**-36.521**	4.024	5.435			no	1.255	-4.621	yes	SYM
	EMU	-19.587	-21.177	-23.510	-18.641	**-24.748**	5.793	6.498			no	0.585	-2.088	yes	SYM
France	Full	78.407	76.427	72.602	78.186	**68.940**	5.721	9.256			no	0.063	-0.917	no	STD
	Pre-EMU	29.103	26.211	28.152	29.561	**22.722**	4.215	6.538			no	0.070	-0.434	no	STD
	EMU	-3.920	-4.168	-3.866	-4.031	**-5.339**	6.583	1.103			yes, sym.	1.095	-2.865	yes	SYM
Germany	Full	-19.812	-22.480	**-28.378**	-21.116	-23.075	6.341	10.944	0.138	10.927	yes, asym.	0.353	-2.646	yes	BTAR
	Pre-EMU	-41.853	-42.221	-43.540	-40.799	**-45.274**	2.868	4.404			no	0.308	-2.004	no	STD
	EMU	-21.516	-22.703	**-23.647**	-20.460	-20.804	2.368	3.949	1.163	2.731	no	0.594	-1.554	yes	SYM
Ireland	Full	37.106	35.440	**29.508**	36.851	35.068	6.141	7.974	0.180	8.911	yes, asym.	0.655	-3.435	yes	BTAR
	Pre-EMU	10.077	9.489	**1.463**	10.273	7.986	6.635	10.080	0.003	9.401	yes, asym.	0.649	-2.903	yes	BTAR
	EMU	-13.993	-14.850	**-15.010**	-13.179	-14.219	2.779	2.960	1.124	1.970	no	0.824	-2.146	yes	STD
Italy	Full	75.888	75.075	73.185	72.100	**69.719**	3.653	6.027			no	0.178	-2.367	no	STD
	Pre-EMU	25.615	21.013	21.372	22.912	**19.594**	4.654	7.192			no	0.282	-2.814	no	STD
	EMU	-24.174	**-25.423**	-25.129	-22.708	-24.854	3.769	1.575			no	0.222	-2.411	no	STD
Netherlands	Full	35.825	34.919	**32.975**	35.824	34.957	3.967	4.729	0.003	4.730	no	0.914	-4.397	yes	SYM
	Pre-EMU	-1.091	-3.667	**-4.690**	0.071	-1.603	2.262	4.233	1.698	5.967	no	0.862	-2.657	yes	SYM
	EMU	-7.952	-8.641	**-27.354**	-7.773	-8.191	18.463	30.717	1.624	30.698	yes, asym.	1.232	-3.114	yes	BTAR
Portugal	Full	149.647	145.955	**145.683**	151.526	147.715	3.203	6.247	3.603	4.438	no	0.458	-2.573	yes	SYM
	Pre-EMU	73.258	69.654	**65.301**	73.607	73.152	8.890	9.303	0.861	9.327	yes, asym.	1.556	-5.232	yes	BTAR
	EMU	-3.280	-4.617	**-10.747**	-2.692	-10.285	7.602	9.572	3.661	7.022	yes, asym.	0.470	-2.599	yes	BTAR
Spain	Full	87.828	84.660	**80.689**	87.916	86.232	4.655	9.294	0.381	5.574	no	0.924	-4.717	yes	SYM
	Pre-EMU	33.687	31.000	30.419	34.317	**29.487**	2.444	4.424			no	0.800	-2.799	yes	SYM
	EMU	-0.267	-1.071	0.582	-0.059	**-2.442**	6.040	1.748			yes, asym.	1.574	-3.781	yes	MTAR*

Note: The critical values for the co-integration and asymmetry tests of the best TAR model are listed in Enders and Siklos (2000). The critical values vary depending on the type of TAR model, the sample size, and the lag length of the model. As approximate benchmarks, one can consider test statistics of 6.0 or higher for the co-integration test and test statistics of 2.5 and higher to allow the rejection of the null hypothesis. – The minimum AIC value of the optimal TAR model is represented in **bold**.

Table A6. Extended pass-through of money market rate innovations onto ending rates in Europe
Panel A. Mortgage lending rates

Country	Period	Model	Impact multiplier β_2	Long-run multiplier θ	Error correction speed of adjustment			Optimal threshold a_0*	Lags	
					$\beta_{ECT,1}$	$\beta_{ECT,2}$	$\beta_{ECT,3}$		k*	n*
Austria	Full	STD								
	Pre-EMU	STD								
	EMU	BTAR	0.131	0.572	-0.535	-14.995	-0.213	0.007	3	0
			(2.212)	(19.055)	(-1.702)	(-2.366)	(-1.565)			
		SYM	0.133	0.572	-0.436				3	0
			(2.909)	(19.055)	(-5.508)					
Belgium	Full	STD								
	Pre-EMU	STD								
	EMU	MTAR*	0.355	0.777	-0.091	-0.116		-0.234	1	0
			(1.881)	(7.953)	(-0.934)	(-0.601)				
Finland	Full	STD								
	Pre-EMU	BTAR	0.304	1.032	-0.082	-10.617	0.057	0.009	1	1
			(3.510)	(16.684)	(-0.960)	(-0.858)	(0.908)			
		SYM	0.315	1.032	0.023				1	2
			(3.749)	(16.684)	(0.660)					
	EMU	BTAR	0.479	0.809	-0.902	1.090	-0.130	0.089	1	0
			(2.857)	(28.301)	(-1.433)	(-1.413)	(-0.355)			
France	Full	MTAR*	0.138	0.627	0.002	-0.037		0.282	3	0
			(2.200)	(6.615)	(0.022)	(-1.915)				
	Pre-EMU	MTAR*	-0.080	0.544	0.104	-0.024		0.246	4	0
			(-1.044)	(6.551)	(0.748)	(-0.954)				
	EMU	MTAR*	0.448	0.489	-0.724	-0.726		-0.103	1	1
			(3.127)	(16.533)	(-2.426)	(-1.161)				
Germany	Full	MTAR*	0.488	0.773	-0.050	2.353		-0.365	2	4
			(3.959)	(7.264)	(-1.551)	(0.412)				
	Pre-EMU	STD								
	EMU	STD								
Ireland	Full	MTAR*	0.156	0.781	-0.195	0.550		-0.858	2	1
			(2.149)	(14.839)	(3.543)	(1.204)				
	Pre-EMU	BTAR	0.205	0.492	-0.081	-0.228	-0.251	0.359	3	1
			(3.809)	(7.997)	-0.781)	(-1.796)	(-1.555)			
	EMU	STD								
Italy	Full	STD								
	Pre-EMU	SYM	0.262	1.046	-0.061				3	2
			(1.660)	(23.239)	(-0.936)					
	EMU	SYM	0.314	0.444	-0.383				1	0
			(2.047)	(9.069)	(-2.643)					
Nether-	Full	STD								
lands	Pre-EMU	STD								
	EMU	STD								
Portugal	Full	STD								
	Pre-EMU	STD								
	EMU	SYM	-0.100	0.756	-0.302				1	0
			(-0.856)	(11.277)	(-3.561)					
Spain	Full	SYM	0.150	1.079	-0.027				2	2
			(3.643)	(53.388)	(-0.855)					
	P re-EMU	SYM	0.144	1.139	-0.047				1	2
			(2.901)	(45.123)	(-0.879)					
	EMU	SYM	0.064	0.692	-0.304				1	0
			(1.179)	(17.209)	(-4.499)					

Table A6 cont., Extended pass-through of money market rate innovations onto lending rates in Europe
Panel B. Consumer lending rates

Country	Period	Model	Impact multiplier β_2	Long-run multiplier θ	Error correction speed of adjustment			Optimal threshold a_0*	Lags	
					$\beta_{ECT,1}$	$\beta_{ECT,2}$	$\beta_{ECT,3}$		k*	n*
Austria	Full	STD								
	Pre-EMU	STD								
	EMU	SYM	0.236	0.598	-0.357				1	0
			(3.181)	(18.522)	(-3.143)					
Belgium	full	MTAR*	1.033	1.451	-0.006	-0.170		0.140	2	3
			(3.711)	(7.142)	(-0.050)	(-3.032)				
	Pre-EMU	STD								
	EMU	SYM	0.509	0.709	-0.084				1	0
			(2.312)	(12.238)	(-0.360)					
Finland	Full	STD								
	Pre-EMU	MTAR*	0.284	1.089	1.349	0.039		0.501	2	1
			(0.762)	(14.599)	(1.852)	(0.358)				
	EMU	BTAR	0.473	0.777	-0.634	0.906	-0.175	0.070	1	0
			(3.133)	(26.943)	(-1.180)	(1.053)	(-0.502)			
France	Full	MTAR*	-0.077	0.658	0.008	-0.076		0.307	3	0
			(-1.121)	(6.302)	(0.110)	(-3.691)				
	Pre-EMU	SYM	-0.153	0.632	-0.044				3	0
			(-1.563)	(7.204)	(-1.353)					
	EMU	MTAR*	0.056	0.224	-0.613	-0.595		-0.004	1	0
			(0.632)	(9.361)	(-1.768)	(-2.321)				
Germany	Full	STD								
	Pre-EMU	STD								
	EMU	STD								
Portugal	Full	SYM	0.307	1.601	-0.269				1	0
			(0.629)	(24.035)	(-2.865)					
	Pre-EMU	SYM	0.251	1.692	-0.543				1	0
			(0.303)	(21.397)	(-3.845)					
	EMU	BTAR	0.383	1.602	-0.147	-0.78	-0.354	0.188	1	0
			(0.735)	(24.035)	(-0.711)	(-0.432)	(-.207)			
Spain	Full	SYM	0.682	1.217	-0.196				1	0
			(5.107)	(41.880)	(-2.747)					
	Pre-EMU	SYM	0.704	1.246	-0.264				4	0
			(4.371)	(36.998)	(-2.766)					
	EMU	BTAR	0.261	0.584	-0.400	-1.167	-0.838	0.045	1	0
			(0.886)	(8.302)	(-1.053)	(-0.254)	(-1.911)			

Table A6 cont., Extended pass-through of money market rate innovations onto lending rates in Europe
Panel C. Corporate lending rates

Country	period	Model	Impact multiplier β_2	Long-run multiplier θ	Error correction speed of adjustment			Optimal threshold a_0*	Lags	
					$\beta_{ECT,1}$	$\beta_{ECT,2}$	$\beta_{ECT,3}$		k*	n*
Austria	Full	STD								
	Pre-EMU	STD								
	EMU	SYM	0.332	0.583	-0.406				1	0
			(3.807)	(18.256)	(-3.029)					
Belgium	Full	MTAR*	0.924	0.971	-0.314	0.133		-0.210	3	0
			(8.457)	(36.378)	(-2.149)	(0.385)				
	Pre-EMU	SYM	0.196	0.934	-0.481				1	4
			(3.123)	(26.368)	(-2.449)					
	EMU	SYM	0.801	0.996	0.127				1	0
			(3.781)	(22.754)	(0.393)					
France	Full	STD								
	Pre-EMU	STD								
	EMU	SYM	0.657	0.828	-0.522				1	0
			(3.050)	(16.688)	(-2.426)					
Germany	Full	BTAR	0.104	0.688	-0.044	7.254	-0.147	0.005	4	1
			(1.779)	(19.949)	(-0.346)	(0.463)	(-1.484)			
	Pre-EMU	STD								
	EMU	SYM	0.128	0.684	-0.249				1	0
			(2.050)	(6.898)	(-2.975)					
Ireland	Full	BTAR	0.242	0.602	-0.067	0.029	-0.385	0.162	3	1
			(4.782)	(27.054)	(-0.599)	(0.122)	(-3.010)			
	Pre-EMU	BTAR	0.274	0.582	0.017	-0.462	-0.494	0.165	3	1
			(4.694)	(11.010)	(0.137)	(-1.288)	(-3.108)			
	EMU	STD								
Italy	Full	STD								
	Pre-EMU	STD								
	EMU	STD								
Nether-lands	Full	SYM	0.368	0.988	-0.237				4	1
			(4.512)	(27.541)	(-2.868)					
	Pre-EMU	SYM	0.194	1.040	-0.212				3	0
			(1.847)	(16.124)	(-1.983)					
	EMU	BTAR	0.272	0.924	-1.786	675.389	-0.047	0.00001	1	0
			(1.241)	(21.381)	(-1.847)	(1.723)	(-0.135)			
		SYM	0.339	0.924	-0.777				1	0
			(2.324)	(21.381)	(-4.700)					
Portugal	Full	SYM	0.479	1.498	-0.315				2	0
			(2.078)	(36.254)	(-4.833)					
	Pre-EMU	BTAR	0.344	1.442	-1.335	136.245	-0.084	0.006	2	0
			(0.929)	(39.361)	(-4.681)	(1.934)	(-0.315)			
		SYM	0.158	1.442	-0.666				2	0
			(0.403)	(39.361)	(-3.897)					
	EMU	BTAR	0.338	0.556	-0.445	0.178	-0.857	0.185	1	0
			(1.472)	(6.968)	(-1.747)	(0.324)	(-3.067)			
Spain	Full	SYM	0.593	0.999	-0.361				3	0
			(5.517)	(61.051)	(-3.802)					
	Pre-EMU	SYM	0.620	1.036	-0.147				1	1
			(5.792)	(48.390)	(-1.078)					

EMU	MTAR*	0.565	0.825	-1.040	-0.933		-0.027	1	0
		(2.002)	(13.586)	(-.319)	(-2.141)				

Note: t-statistics are given in parentheses. Results for the standard model (STD) are reported in Table A4.