FROM FRAGMENTATION TO INTEGRATION? UNDERSTANDING THE RECENT EVIDENCE FROM EUROPEAN RETAIL BANKING MARKETS

by
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Abstract
This paper investigates the state and frontiers of integration in European retail banking markets. A comparative analysis of three types of integration measures is conducted and discussed in detail: Quantity-based, price-based and news-based measures of integration. Quantity-based measures focus on the channels of integration, i.e. on cross-border activities and point to a severe lack of integration. The recent wave of cross-border M&As, however, indicates that the integration process may have started to gain momentum. In contrast, price-based analyses, which are motivated by the law-of-one-price, paint a picture of advanced convergence. However, the applicability of the law-of-one-price in retail banking markets is questionable and the convergence results are largely driven by wholesale market integration. Better suited alternatives are analyses employing cointegration methodologies, convergence analyses of interest rate margins, and news-based measures of integration which investigate the degree of heterogeneity of the response of retail banking prices to common shocks. All latter analyses confirm the lack of integration, but are also revealing differing degrees of integration in the various sub-segments of the market. Furthermore, the integration process is at least partly driven by global rather than regional factors, while the most important regional factor in reducing differences between national interest rates are integrating wholesale markets in the presence of a single monetary policy. Moreover, the lack of integration is especially severe in the old member states and less so in the new member states where the fraction of foreign banks is substantially higher. Given the still low degree of integration we conclude that an intensified integration process is likely in the near future, but this process may fall short of the full integration vision the single market project of Europe 1992.

Keywords: European banking, banking market integration, European Union, integration measures, convergence, cointegration, pass-through.

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1. Introduction

Banks have always played an important role in Europe’s financial system. Historically, the European banking system developed from the unit-based banking system of the 17th and 18th century to the early 19th century’s bi-polar system consisting of town-based banks financing domestic and international trade and country-based banks financing the local, predominantly agricultural economy. By the end of the 19th century, most European countries had a nationwide branch system. The competition between country-based (regional) banks and town-based (national) banks differed across countries and led to heterogeneity still found in European banking today. Furthermore, the relationship between industry and banks shaped the market. Whereas in the United Kingdom (UK), banks financed mostly trade and to a lesser extent industry, the ties between industry and banks were much closer in continental Europe. Consequently, the UK developed a more market-oriented financial system whereas the continental European system became mainly bank oriented. In general, however, bank lending plays a dominant role in providing funds to the corporate, private, and public sector throughout Europe. In 2001 bank loans amounted to about 109.6 per cent of the gross domestic product (GDP) in the European Union (EU) compared to only 40.7% in the United States (US) and compared to a similar but decreasing level of 79.7% in Japan. In contrast, market based forms of funding, and here in particular bond finance, are used to a lesser extent in the EU as Figure 1 shows. Furthermore, bank lending is increasing in importance in Europe compared to the decreasing importance in the US and Japan. Not surprisingly, bank finance amounts to a substantial 33% of European firm’s financing sources as Figure 2 illustrates. The situation in the new Central and Eastern European (CEE) member states is much less clear. While financial development indicators still signal underdevelopment in all three areas, it appears, however, that in many countries the banking system is relatively more important than the other sources of finance, though the situation differs from country to country. Moreover, banking is developing fast, not the least because of an increasing influx of foreign direct investment into the CEEC banking system in the recent years.

The motivation for regional integration in Europe is clearly political, eventually even aiming at the ultimate goal of creating a United States of Europe as advocated by Jean Monnet. However, the means to achieve this objective have always been economic. The Treaty of Rome of 1957 identifies in Article 2 the creation of a unified economic area with a common market as the task of the Community. In a unified market consumers and producers should have equal opportunities everywhere within the Community regardless of their country of origin. With respect to the creation of a single market for financial services, key regulatory milestone include the 1957 Treaty of Rome, the 1977 First Banking Directive, the 1985 Second Banking Directive, the 1992 Maastricht Treaty on European Union, and the 1999 Financial Services Action Plan. Dermine (2002) argues that each of them characterizes a new phase in Europe’s legal environment: Deregulating entry (1957-1973), the harmonization of banking regulations (1973-1983), the completion of the internal market (1983-1992), the creation of the single currency, 1999, and the Financial Services Action Plan (1999-2005). Regarding the importance of the European Monetary Union (EMU), Tommaso Padoa-Schioppa (2000) from the European Central Bank (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”. From a purely regulatory perspective, European banking markets can be considered quite advanced but not yet perfectly harmonized. In practice, however, most observers point to a
severe lack of market integration. In a survey article on European banking market integration, Freixas (2003) concludes that “[B]arriers to entry are still today's most relevant challenge of European financial integration.” Differences in objectives between European and national regulators (just witness ABN-Amro’s struggle to obtain the controlling share in Italy’s Antonveneta in September 2005) as well as the persistence of non-regulatory barriers to integration – such as cultural differences in consumer behaviors, for example preferences for types of credit – continue to exist. In a market where proximity to customers remains important even in an age of modern distribution technology, legal integration might be insufficient to create market integration. In a study on global integration in the banking industry, Berger (2003) argues that “despite ... reduced barriers, the integration of the banking industry in most developed countries has fallen short of the expectations of many observers. As a major reason for this Berger argues that “…foreign banking organizations may be at significant competitive disadvantage in providing the price, quality, and mix of services that best suit bank customers, and that such disadvantages may limit the integration of the banking industry.”

Figure 1
The relative importance of bank versus market finance

Source: Data obtained from exhibit 1.1.1. in the annex to the 2004 Financial Integration Monitor, European Commission (2004).
Figure 2
The importance of bank loans as a source of finance of euro-zone non-financial corporations

Source: Exhibit 1.2.1. in the annex to the 2004 Financial Integration Monitor, European Commission (2004).
Data refers to 2002. The financing structure is given in percent of liabilities.

Against this background, it may be less surprising that in a review assessing the progress of Europe’s retail banking market integration in 2002, the European Commission (2002:4) thus concluded:

"Retail markets for financial services are still segmented. This reduces choice for consumers and enterprises. Financial institutions cannot market a financial product EU-wide, but have to design and market 15 different products for 15 different Member States. ... Cross-border retail payments are expensive, and have not fallen over the past decade. In 1993, the average charge for an EU cross-border credit transfer of €100 was €23.93. In 2001, the average charge had risen to €24.09. ... Large financial institutions are still confronted with multiple rules and reporting requirements. A typical large financial institution has to report to over 20 supervisors in the EU."
Two years later, the European Commission (2004:4-5) did not have much cause to revise its conclusions:

“Progress is not the same in all market segments, as witnessed by the variety in the evolution of prices and volumes of cross-border trading flows: the two extremes of the spectrum are the unsecured money market and the market for consumer loans to households. ... Direct cross-border activity mainly takes place in big volume markets. Direct cross-border offer of retail financial products remains the exception rather than the rule.”

It thus appears that there is a widespread consensus among policy makers and academics that European retail banking integration is lagging behind the ultimate objective of providing a single market for financial services for Europe. This evaluation has recently led the EU Commission (2005a) to publish a Green Paper on financial service policies over the period 2005-2010. The focus is now on implementing existing rules rather than to create new ones. Moreover, after realizing the slow progress in retail banking market integration which is at least partly caused by a fragmentation of national regulation for financial products in the 25 EU member countries, the Commission is considering the idea of creating a 26th regime, i.e. to grant specific financial products (i.e. mortgages) a special European status.

2. Meaning, measurement and potential benefits an integrated retail banking market

In an influential study Adam et al. (2002) state: “Financial markets are integrated when the law of one price holds”. As such, identical assets should sell at one single price regardless of the domicile of the consumer or producer of that financial asset. An identical product priced differently across countries would thus point to the presence of legal and/or economic barriers to a free flow of financial services across borders and indicate the existence of unexploited arbitrage opportunities. Consequently, by integrating financial markets, welfare gains could be expected. Choosing the law of one price as the point of reference for market integration directly relates back to the major argument of the Cecchini study (Commission of the European Communities, 1988) for creating a single European market. According to this view gains from trade should materialize as an increase in consumer rents when markets are being integrated and prices are falling. More precisely, the Cecchini study predicted that post-integration prices will fall to a level equal to the prices of the country with the lowest pre-integration prices. Gardener and Teppett (1995) estimate that these price reductions range between 21% and 4% for the different member countries with an average reduction of 11% and are expected to result in a total gain in consumer surplus of 21.6 billion ECU for the then eight member states: Belgium, Germany, Spain, France, Italy, Luxembourg, The Netherlands, and The United Kingdom.

In financial markets the law of one price manifests itself as the interest rate parity (IRP). For integrated European retail banking markets, the law of one price implies that the prices for retail banking products – such as interest rates on loans or deposits – should be equal across countries. For financial markets in general, it is well established that under perfect capital mobility the covered IRP typically holds while it is more difficult to establish the empirical validity of the uncovered IRP due to exchange rate volatility or exchange rate expectations. However, with the introduction of the single currency on January 1st, 1999, exchange rates are no longer a concern at least within the euro zone. Thus, for monitoring retail banking market integration within the euro zone, convergence of retail prices is sufficient. This is not
true, however, for non-euro zone EU members, where these measures are distorted by exchange rate risks. Arbitrage mechanisms are underlying the IRP. More specifically one can think of an international arbitrage process where banks increasingly shift their lending activities to countries where lending rates are the highest while consumers borrow in low-interest countries. In more practical terms, one can visualize banks entering each national market and offering services to local customers. Alternatively, banks might offer products to customers in different countries via internet. In addition, customers obtain banking services from banks located abroad. These channels are also illustrated in Table 1.

Table 1
Financial integration channels

<table>
<thead>
<tr>
<th>Channel</th>
<th>Strategy</th>
<th>Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank-driven channel</td>
<td>local ownership</td>
<td>branches</td>
</tr>
<tr>
<td></td>
<td></td>
<td>subsidiaries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>mergers and acquisitions</td>
</tr>
<tr>
<td></td>
<td>local intermediation</td>
<td>ATM</td>
</tr>
<tr>
<td></td>
<td>distribution</td>
<td>internet</td>
</tr>
<tr>
<td></td>
<td></td>
<td>phone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>credit card</td>
</tr>
<tr>
<td>Consumer-driven channel</td>
<td>local purchase from foreign owned bank</td>
<td>diverse distribution channels</td>
</tr>
<tr>
<td></td>
<td>local purchase of foreign product</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cross-border purchase</td>
<td></td>
</tr>
</tbody>
</table>


Walkner and Raes (2005) argue that financial market integration has both direct effects through increased competition and indirect effects on the banking sector in terms of client welfare and operating/profit/overall efficiency. Regarding the competitive effect of integration, it is assumed that the entry of foreign banks induces domestic banks to compete and improve their services. Academic evidence suggests that the presence of foreign banks does indeed lead to a reduction in profitability and margins of domestic banks. On the other hand, reduced profitability can make domestic banks more vulnerable to distress, i.e. when prudential regulations and supervisory structures are weak. Additionally, one can also argue the not only market entry itself but also the threat of it – as suggested by the theory of contestable markets – could have the described effects. Regarding the effect of integration via concentration on client welfare and efficiency, Walkner and Raes (2005) expect a significant amount of consolidation in the European banking market which in turn will lead to a more competitive market with improved economies of scale and scope for bank. However, academic evidence with respect to the resulting effects on client welfare remains mixed with some indication of consolidation-driven welfare gains in moderately concentrated banking

Walkner and Raes (2005) also point out two possible effects of integration on macroeconomic stability. On the one hand, “geographic bank diversification smoothenes the respective overall bank holdings’ business volatility and thus stabilises borrowing conditions for the respective bank clients” whereas on the other hand “banks cease lending in an environment of economic decline and export their capital to other, more promising, economies, thus aggravating a local economic downturn.”
markets driven by lower lending rates, increased deposit rates, and improved credit access. These benefits are balanced by a disruption of bank-client relationships which particularly affects small borrowers. Regarding efficiency effects, the evidence is controversial. Whereas studies investigating the effects of bank mergers find only limited economies of scale, other studies find overall improved efficiency and resilience to economic shocks for the whole sector.

Choosing the law of one price as the reference point for financial market integration may have, however, serious shortcomings, especially with respect to retail markets:

- Price differences in retail markets may not only reflect legal barriers and regulatory differences that can be harmonized away but also display deeply rooted differences in financial structures, economics risk, information asymmetries and preferences that may prevail. Thus retail banking prices may never fully equalize but eventually only move together. Methodologically speaking, the prices would then only be co-integrated.

- Even in product markets where information imperfections are less distorting than in financial markets it has been shown that the law of one price may not hold even for similar goods. Engel and Rogers (1996) have shown that similar goods can have different prices in different places not only because of transportation cost (measured by distance) but also due to the existence of borders. This holds even when there is free flow of goods and the distance (transportation costs) is controlled for. The authors attribute this failure of the law of one price at least partly to national differences in nominal price stickiness. Thus, national retail rates would only move in tandem across borders when the degree of price stickiness is similar across the integrating countries and the marginal costs of producing retail banking product is equalized, e.g. by a single monetary policy. Thus, when money market rates equalize by means of an international arbitrage process in a monetary union such changes have an impact on lending and deposit rates via domestic competition and other market characteristics.

- The law of one price ignores other product characteristics such as product variety, product quality and efficiency, or profitability of the financial service provider. Therefore the European Commission (2005b) has adopted a broader, process-oriented definition of integration: “Financial integration is a process, driven by market forces, in which separate national financial markets gradually enter into competition with each other and eventually become one financial market, characterized by converging prices, product supply and converging efficiency/profitability among the financial services providers. Several distinct and parallel channels can further financial integration, namely: cross-border ownership, establishment or cross-border service provision.”

Based on these considerations Baele et al. (2004) distinguish three types of measures of integration: quantity-based measures, price-based measures, and news-based measures.

- The channels of integration are best assessed by directly looking at banking activities including number of cross-border mergers and acquisitions (M&As), number of foreign owned banks, number of foreign branches, market share of foreign banks in loan and deposits, or the share of foreign loans and deposits on bank’s balance sheet. In an integrating market, these numbers should increase over time. These measures are typically referred to as quantity-based indicators.

- The law of one price is best assessed by employing price-based indicators. These indicators typically look at prices of retail banking products, i.e. interest rates on loans and deposits. Integration should be observable via converging interest rates. In as far as integration has lead to increased competition there should also be evidence of falling interest rates or spreads. Thus, price-based measures can focus also on margins. Since...
retail interest rates also reflect macroeconomic factors, bank margins offer a better understanding of the integration process than retail rates in periods when market interest rate are converging due to a reduction and final elimination of the exchange rate risks in a monetary union.

**News-based measures** focus on the driving force behind interest rate changes and are thus in some sense related to price-based measures. The driving force chosen in studies employing news-based measures is typically a market interest rate. The pass-through of this common factor onto retail interest rates is then investigated. Thereby, it is investigated to what extent is the observed convergence of retail interest rates is driven by the fact that these rates are now responding to a common monetary policy. If the market characteristics converge in the sense that the retail price reaction to changes in costs will converge in terms of price stickiness across countries, the law of one price may hold then at least in its relative version, i.e. the rate of price changes should converge.

However, there are concerns in particular from the European Commission (2004: 2) that these measures do not provide the full picture: “It is clear that conclusions on the advance of integration cannot be based on one indicator alone. Price and quantitative indicators do not provide the full picture. That is why the Commission, in a complementary exercise, will add to this picture with a broad consultation of stakeholders on regulatory and other obstacles to a proper functioning of the internal market. This will in particular provide pragmatic, qualitative insight on whether absence of integration is due to policy barriers or to economic and structural considerations.” Therefore, the European Commission (2005b) considers *product availability* and *efficiency & market concentration* measures of integration. Product availability (access) measures the available product range, the ease of access (e.g. through different distribution channels) and the quality of product information; efficiency/market concentration measures to what extent integration has created intra-market competition between banks. An integrated market could be expected to move towards efficiency convergence and the same level of concentration within and across national markets.

In the following we will review the evidence on the current state of European retail banking market integration by means of the above-discussed indicators.

3. European retail banking market integration: Where do we stand?

3.1. Evidence from quantity-based measures of integration

Quantitative measures of integration focus on the channels of integration as illustrated in Table 1 and employ empirical proxies of integration such as the number of cross-border M&A, number of foreign owned banks, number of foreign branches, market share of foreign banks in loan and deposits, or the share of foreign loans and deposits on bank’s balance sheet. The survey by Walkner and Raes (2005) as well as the annual Financial Integration Monitor of the European Commission (2004, 2005) provide the most recent evidence in this area. As Table 2 clearly indicates, the European banking market has undergone a period of consolidation in all countries. From 1997 to 2003, the number of credit institutions decreased on average by about 23% in the EU as well as in the euro zone. Over the same time period, the number of branches in total or per 100,000 inhabitants dropped with 7.5% to 10% less steeply.
Table 2
Consolidation of the European banking market

<table>
<thead>
<tr>
<th>Country/Year</th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>1997-03 change in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>131</td>
<td>123</td>
<td>117</td>
<td>118</td>
<td>112</td>
<td>111</td>
<td>108</td>
<td>-17,6</td>
</tr>
<tr>
<td>Denmark</td>
<td>213</td>
<td>212</td>
<td>210</td>
<td>210</td>
<td>203</td>
<td>178</td>
<td>203</td>
<td>-4,7</td>
</tr>
<tr>
<td>Germany</td>
<td>3420</td>
<td>3238</td>
<td>2992</td>
<td>2742</td>
<td>2526</td>
<td>2363</td>
<td>2225</td>
<td>-34,9</td>
</tr>
<tr>
<td>Greece</td>
<td>55</td>
<td>59</td>
<td>57</td>
<td>57</td>
<td>61</td>
<td>61</td>
<td>59</td>
<td>7,3</td>
</tr>
<tr>
<td>Spain</td>
<td>416</td>
<td>404</td>
<td>387</td>
<td>368</td>
<td>368</td>
<td>359</td>
<td>348</td>
<td>-16,3</td>
</tr>
<tr>
<td>France</td>
<td>1258</td>
<td>1226</td>
<td>1158</td>
<td>1099</td>
<td>1050</td>
<td>989</td>
<td>939</td>
<td>-25,4</td>
</tr>
<tr>
<td>Ireland</td>
<td>71</td>
<td>78</td>
<td>81</td>
<td>81</td>
<td>88</td>
<td>85</td>
<td>80</td>
<td>12,7</td>
</tr>
<tr>
<td>Italy</td>
<td>909</td>
<td>934</td>
<td>890</td>
<td>861</td>
<td>843</td>
<td>821</td>
<td>801</td>
<td>-11,9</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>215</td>
<td>212</td>
<td>211</td>
<td>202</td>
<td>194</td>
<td>184</td>
<td>172</td>
<td>-20,0</td>
</tr>
<tr>
<td>Netherlands</td>
<td>648</td>
<td>634</td>
<td>616</td>
<td>596</td>
<td>561</td>
<td>539</td>
<td>481</td>
<td>-25,8</td>
</tr>
<tr>
<td>Austria</td>
<td>928</td>
<td>898</td>
<td>875</td>
<td>848</td>
<td>836</td>
<td>823</td>
<td>814</td>
<td>-12,3</td>
</tr>
<tr>
<td>Portugal</td>
<td>238</td>
<td>227</td>
<td>224</td>
<td>218</td>
<td>212</td>
<td>202</td>
<td>200</td>
<td>-16,0</td>
</tr>
<tr>
<td>Finland</td>
<td>348</td>
<td>348</td>
<td>346</td>
<td>341</td>
<td>369</td>
<td>369</td>
<td>366</td>
<td>5,2</td>
</tr>
<tr>
<td>Sweden</td>
<td>237</td>
<td>223</td>
<td>212</td>
<td>211</td>
<td>211</td>
<td>216</td>
<td>222</td>
<td>-6,3</td>
</tr>
<tr>
<td>UK</td>
<td>537</td>
<td>521</td>
<td>496</td>
<td>491</td>
<td>452</td>
<td>451</td>
<td>426</td>
<td>-20,7</td>
</tr>
<tr>
<td>Euro area 12</td>
<td>8637</td>
<td>8361</td>
<td>7954</td>
<td>7521</td>
<td>7218</td>
<td>6908</td>
<td>6593</td>
<td>-23,7</td>
</tr>
<tr>
<td>EU 15</td>
<td>9624</td>
<td>9337</td>
<td>8872</td>
<td>8433</td>
<td>8084</td>
<td>7751</td>
<td>7444</td>
<td>-22,7</td>
</tr>
</tbody>
</table>

Source: Table 1 in Walkner and Raes (2005). The table presents the number of credit institutions per year.

A large part of this consolidation is driven by bank M&As. However, as Figure 3 illustrates, the vast majority of M&As take place between two domestic banks. As Walkner and Raes (2005:22) state: “According to the available data, cross-border mergers and acquisitions have not been a major feature of the EU banking sector. In terms of numbers, mergers and acquisitions among domestic credit institutions represent about 80 percent of total consolidation activity in the EU in each year since 1992. The only clear pickup in cross-border mergers and acquisitions is evident in the run up to the creation of the single market in 1992, when the share of domestic mergers fell to about 60 per cent. However, cross-border mergers and acquisitions have never come close to exceeding domestic mergers and acquisitions.”

Very recently, however, cross-border M&As have been gaining momentum. The Dutch ING Bank bought German and Belgian banks, German HypoVereinsbank first acquired Austrian and CEE banks and has subsequently been bought by the Italian UniCredito, the Spanish Santander took over the British Abbey National, Dutch ABN-Ambro succeeded in buying Italian Antonvenenta, and most recently French BNP-Paribas bid for the Italian Banco Nazionale del Lavoro, and finally Nordea Bank AB’s merger with four Scandinavian banks. What makes this last case so interesting from a market integration point of view is that Nordea established a single corporate structure using the status of a European Company, a.k.a Societas Europaea. While this clearly is a large step forward it also raises a number of regulatory issues with respect to supervision and deposit insurance (for a detailed discussion see Dermine 2005).
Figure 3
Mergers and acquisition in European banking markets

Source: Graph 1 and 2 in Walkner and Raes (2005).
Next to M&As, banks can also achieve a foreign presence via local ownership of subsidiaries or branches. As Figure 4 illustrates, the number of foreign branches of EEA banks in the EU has slowly but steadily increased between 1997 and 2002. The number of subsidiaries has however remained almost constant. It is therefore not surprising that the assets of these branches and subsidiary amount to only a small fraction in terms of GDP. However, with the introduction of the Societas Europaea the trend towards cross-border branching could eventually gain momentum in the future.

It is however also possible for banks to penetrate a foreign market without being physically present. Figures 5 and 6 provide information regarding the cross-border purchase and supply of banking products both in terms of bank assets as well as loans to non-banks. Looking at cross-border assets in Figure 5 reveals that on average less than 20 per cent of total assets are cross-border within the EU. This percentage is hardly increasing. Furthermore, there are substantial national differences ranging from highly integrated markets in Luxembourg and Sweden to hardly integrated markets in Germany. Figure 6 provides a picture closer related to retail banking by focusing on cross-border loans to non-banks. Again there is little indication for integration with cross-border loans amounting to only 1% to 3% of total loans. The results shown here are in line with the findings of other studies regarding cross-border loans as well as deposits to non-banks. Baele et al. (2004) furthermore argues that the slightly increasing trend towards more cross-border lending is mainly driven by non-euro zone banks.

Figure 7 and 8 finally focus on the consumer-driven channel of integration and here in particular on the willingness and ability of customers to obtain cross-border financial services. Whereas the low levels of currently obtained cross-border financial services, i.e. mortgages, reported in Figure 7 are in line with Figure 6, the increase in customers’ planned demand allows for a more optimistic view on retail banking market integration. Part of this increased demand might well be driven by easier access to cross-border financial services. As Figure 8 illustrates, the cost of cross-border transfers has falling in most European countries.

Overall, these observations are in line with the common conclusion of quantity-based studies that the integration process is still very incomplete (see e.g. Cabral et al. 2002) at least in the old 15 EU member countries. This observation was, however, also made when the USA deregulated the banking market in the 1980s and 1990s by lifting the restrictions on interstate branching. Cross-border banking then made a slow start before finally gaining momentum. Nevertheless, US banking has to deal with a much less fragmented legislation as well as a historically and culturally less diverse background than European banking. When turning to the new Central and Eastern European EU member states the story is different, as foreign banks basically contributed largely to the build-up of a financial infrastructure in these countries (see Figure 9). Thus, the evidence is supporting the view voiced by Berger (2003) that there are powerful market forces favoring the local banking industry that may not easily be overcome by reducing entry barriers. In contrast, in less developed countries and in particular transition countries where financial system had to be build-up from scratch the foreign banking industry can play an important role. In sum, the evidence points to a still fragmented European banking system, but also indicates that the integration process is slowly gaining momentum. How far this integration process can go remains to be seen.
Figure 4
Market integration via local ownership – the presence of EEA banks in the European Union

![Graph showing the number of subsidiaries and branches, and assets of subsidiaries and branches over the years 1997 to 2002. The x-axis represents the years, and the y-axis represents the number of subsidiaries and branches in millions, and the percentage of assets of subsidiaries and branches.]

Source: Exhibit 1.1.16. in the annex to the 2004 Financial Integration Monitor, European Commission (2004). The right-hand side axis indicates the number of subsidiaries and branches whereas the left-hand side axis indicates the assets in percent of GDP.
Figure 5
Cross-border penetration of European banks

Source: Figure 7 in the background document to the 2005 Financial Integration Monitor, European Commission (2005b).
Figure 6
Cross-border loans to non-banks

![Graph showing cross-border loans to non-banks](image)


Figure 7
Consumers’ cross-border purchases of financial products

![Graph showing cross-border purchases of financial products](image)

Source: Figure 1 in the background document to the 2005 Financial Integration Monitor, European Commission (2005b).
Figure 8
The cost of cross-border credit transfers

Source: Exhibit 1.1.18. in the annex to the 2004 Financial Integration Monitor, European Commission (2004). The data represents the average fee in euros for a cross-border credit transfer of 100 euros.
Figure 9
Foreign banks in the European Union’s new member states

Panel A: Foreign ownership

Panel B: Market concentration and foreign ownership

Source: Panel A is based on data provided in Table 1 and Panel B replicates Chart 4 in the background document to the 2005 Financial Integration Monitor, European Commission (2005b). Panel A represents the percentage of total assets in foreign ownership for 2003. Panel B represents the share of the five largest banks in total banking assets. NMS indicate new member states.
3.2. Evidence from price-based measures of integration

3.2.1. Price convergence measures

Price-based measures have been advocated for a variety of reason, but particularly because these data are readily and more easily available and are typically more accurate than quantity-based measures. They also allow for a more straightforward interpretation and may be better able to reveal long-term trends. Adam et al. (2002) therefore suggest using retail rate convergence measures to monitor the progress in European retail banking market integration. The European Commission (2004, 2005) has followed this suggestion in its annual Financial Integration Monitor report. For a first impression, consider the development of nominal retail interest rates in the euro zone as presented in Figure 10. There appears to be some convergence which has mostly taken place in the mid-1990s. Whereas country differences are smallest at the end of 2002 for mortgage rates, short-term corporate loan rates still show differences of up to 6.2%. Within a sub-group of euro-zone countries excluding Germany, Ireland, and Belgium, however, these rates seem to be more aligned. Nevertheless, more than a decade after the 2nd Banking Directive came into effect and five years after the introduction of the single currency, full convergence of interest rates has not yet been reached in retail banking markets.

For a more formal statistical test, two measures of convergence have been suggested: σ- and β-convergence. σ-convergence measures whether or not interest rates have become more similar over time when compared to each other or to a benchmark rate. In contrast, β-convergence measures the speed with which national interest rates converge. This latter measure has been borrowed from the economic growth literature. In the context of economic growth, countries with low initial levels of economic development should show higher economic growth than countries with high initial levels of economic development. With respect to banking market integration this implies that countries with initially relatively high interest rates should show faster downward adjustment than countries with already low interest rates. Details regarding the methodology are provided in Box 1 in the Appendix.

Figures 11 and 12 show the coefficient of variation or standard deviation, respectively, for the main retail loan types and thus provide an illustration of development of σ-convergence over time. Overall, interest rates have converged in Europe with the exception of rates on consumer loans to households which shows a higher variation in 2002 than in 1993 (see Figure 11). Looking at the more recent data provided in Figure 12 supports this view. Evidence for β-convergence can be observed in Figure 9 most strongly for mortgage rates before 1999 where for example the initially very high Portuguese and Italian rates converged more than the already low Austrian and Belgian rates. These findings are in general supported in the literature (see Baele et al. 2004, Adam et al. 2002). Baele et al. (2004) for example report β-convergence for the pre-EMU period (1990 to 1998) as well as the EMU period (1999-2003) as Figure 13 shows, but find a significant increase in convergence under the single currency only for mortgages. Overall, it has thus been concluded that price-based studies looking at interest rates typically find some evidence for integration. This finding is, however, difficult to reconcile with the obtained quantity-based picture, which signals a lack of integration.

2 In contrast to the methodology outlined in Box 1 in the Appendix, Baele et al. (2004) use the German interest rate as the benchmark rate.
Figure 10
The development of retail interest rates in the euro zone

Panel A: Mortgage rates

Panel B: Short-term corporate loan rates

Source: Panel A and C of Figure 1 in Kleimeier and Sander (2005).
Figure 11
Convergence of interest rates on retail loans between 1993 and 2002

Panel A: Medium, long-term loans to enterprises

Panel B: Short-term loans to enterprises

Panel C: Mortgages

Panel D: Consumer loans to households

Source: Exhibit 1.1.1. to 1.1.4. in the annex to the 2004 Financial Integration Monitor, European Commission (2004). The data represents the coefficient of deviation among national interest rates.
Figure 12
Convergence of interest rates on retail loans between 1999 and 2004

Source: Figure 3 in the background document to the 2005 Financial Integration Monitor, European Commission (2005b). The data represents the cross-sectional standard deviation among interest rates of euro-zone countries.
3.2.2. Limitations of price-convergence measures

Retail banking markets may resist full convergence due to differences in national default risk, cultural influences in bank-client relationship, country-specific strategic bank behavior, the lack of cross-border lending, the lack of international bank mergers, and – at least up to January 1999 – differing monetary policy conditions. Consequently, one may not even expect the law of one price to hold in this market and convergence studies can thus provide misleading results. Therefore, as first advocated in Kleimeier and Sander (2000) an alternative is to employ the concept of cointegration to analyze the state of market integration in retail banking when lending rates are tied together by a long-term equilibrium relationship that does not demand strict price- or product-equalization. Cointegration analyses consider 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” (Engle and Granger 1987). This concept realizes that although full equalization 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 euro zone ($L_{EU}$) as it would be required by the law of one price shown in equation (1):

\begin{equation}
L_{nat} = L_{EU}
\end{equation}
Rather, we accept as a possible long run relationship that the rates may differ from each other such that:

\[ L_{\text{nat}} = a + b L_{\text{EU}} \]

On a bilateral level, one can also investigate these relationships for two national interest rates. For details on cointegration methodology see Box 2 in the Appendix.

Looking first at the early cointegration evidence obtained in Kleimeier and Sander (2000, 2003) over a relatively long period from 1985 to 2002, different phases of cointegration can be identified in the euro zone. Whereas it appears that the retail lending markets are weakly cointegrated before 1993, these links disappear in the mid-1990s. Around the introduction of the single currency, however, cointegration seems to appear again – at least in some retail markets, especially in the short-term corporate loan markets. Roughly speaking, cointegration analysis leads to a yes–no–yes integration pattern over time to which the changes – in particular the ERM crises in 1992/93 – in the exchange rate regime appear to be most important. For the more recent period of the 1990s the role of the single currency is central to the analysis and is by most authors believed to introduce a shift in the structural relationships. Note, however, that as Kleimeier and Sander (2003) have shown for retail lending and deposit rates between 1995 and 2002, the break occurs in many retail markets well before January 1999, thus pointing towards an anticipation of the EMU.

More recent results provided in Kleimeier and Sander (2005) confirm for mortgage and corporate loan rates the earlier mentioned yes-no-yes pattern of bilateral cointegration within the euro zone. For mortgages, cointegration drops from 29 relationships in the pre-EMU sub-period from January 1995 to December 1998 (reflecting 32% of the possible 90 bilateral relationships among the 10 national rates) to as few as 12 only to increase to 40 (44%) during the last, EMU sub-period. Corporate loan rates show a similar pattern but reveal overall higher level of cointegration reaching 57 (63%) bilateral cointegration relationships under the single currency. Cointegration relative to the euro-zone average reveals a similar pattern for corporate loan rates. During the last rolling period from 1999 to 2002 only two countries, Finland and Germany, are not cointegrated with the euro-zone average. On the other hand, very little cointegration can be found for mortgage rates.

When comparing the results of convergence and cointegration measures of integration the most important difference is found in the integration assessment of both, mortgage and corporate loan markets. Simple price convergence measures indicate that mortgage markets are the most integrated of all euro-zone retail lending markets. Cointegration analysis, however, additionally reveals that under the single currency both mortgage and corporate lending rates are now more closely related.

Consolidating these results reveals a weakness of the price-convergence measures in the context of euro-zone retail banking: Whereas the convergence of money market rates in anticipation of and under the single currency has provided a picture of overall convergence of nominal retail banking rates, the image of lack of integration that the quantity-based approaches clearly show is only consistently reflected in cointegration analyses. Loan products as well as lender and borrower behavior remain different across the euro zone. In such an environment, simple price-convergence measures of integration are not well suited. It would indeed be surprising if in a market with different loan products or lending risks, interest rates were equal. In such a setting, cointegration measures of integration are more useful as they allow for these differences across national retail markets.
3.3. Evidence from news-based measures of integration

Pass-through studies, which employ *new-based measures* of integration, are increasingly regarded important for assessing the degree of financial integration in the euro zone retail banking market. The idea underlying this thought is as follows: Rather than cross-border arbitrage, a smooth pass-through of monetary policy rate changes onto lending rates in all EMU member-countries can eventually lead to *tying together* of interest rates and *produce* the
statistical artefact of evidence for or against (co-)integration. Retail interest rates could in principle follow the same time pattern if banks in the different euro-zone countries would pass changes in policy-related interest rates smoothly and with the same speed onto lending rates. A limited pass-through of interest rates could also be interpreted as pointing to a high degree of imperfect competition in retail banking (Cottarelli and Kourelis, 1994). And if the pass-through process is heterogeneous this could be interpreted as a limited institutional convergence process in European retail banking which works against the law of one price.

Most euro-zone pass-through studies are based on a variant of the pioneering work by Cottarelli and Kourelis (1994). Important contributions include BIS (1994), Cottarelli, Ferri and Generale (1995), Borio and Fritz (1995), Mojon (2000), de Bondt (2002), de Bondt et al. (2002), Sander and Kleimeier (2002), Toolsema, Sturm and de Haan (2002), and Heinemann and Schüler (2003). The methodological details regarding pass-through analyses are presented in Box 3 in the Appendix. These studies find considerable differences in the pass-through not only across different bank lending and deposit rates but also across the countries of the euro zone. Moreover, a substantial degree of short-run bank interest rate stickiness is found. At the same time many but not all studies find evidence for a less than full pass-through in the long run which can be read as evidence for credit rationing phenomena. Furthermore, asymmetric adjustment of retail interest rates depending on the type of interest rate shock is regularly documented. Finally, it is often argued that the single currency could act as a unifying force that has the potential to make the pass-through faster, more complete and more homogeneous. Despite these commonalities, the existing studies are often using differing approaches and consequently lead to diverging results. Sander and Kleimeier (2004) therefore introduce a unifying methodological framework (as presented in Box 3 in the Appendix) for analyzing the pass-through process in the euro zone. The results of these pass-through estimates are then used in second-stage regressions to shed light on the role of competition and integration for a more uniform monetary transmission. For the euro zone, we argue that the evidence points to a lack of integration and in particular to the role of legal and cultural differences that may continue to preclude full convergence in the near future even after the introduction of the single currency.

One question addressed by pass-through study of Sander and Kleimeier (2004) is of particular relevance in the context of market integration: To what extent has the response of retail interest rates to monetary policy rates become more similar across countries, i.e. under the single currency? Figure 15 presents a visual answer, which is generally supporting the No, No, and Maybe proposition obtained from the cointegration analyses of mortgage, consumer lending, and short-term corporate lending markets: Mortgage and consumer lending rates show a highly heterogeneous response to monetary policy. For consumer lending rates, the response to monetary policy rates is, however, most heterogeneous and shows even signs of increasing heterogeneity. In line with the increasing signs for a more integrated short-term corporate lending market, the pass-through is not only the fastest but also the by far most homogeneous one. Moreover, this homogeneity is increasing even further in the post-break period. Although improvements in the latter sense are also visible for longer-term

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3 Note that some pass-through studies select as the common factor market interest rates that are most closely related to the retail interest rate under investigation (De Bondt 2002, De Bondt et al. 2002, and Baele et al. 2004). Other studies opt for a money market rate as the common (monetary policy) factor (Mojon 2000, Heinemann and Schüler 2003, Sander and Kleimeier 2002, 2004, Toolsema et al. 2002).
With respect to the pass-through in the new EU member states it is interesting to note that recent research (Opiela 1999, Chmielewski 2004, Crespo-Cuaresma et al. 2004, Horváth et al. 2004, Sander and Kleimeier 2005) has shown that the pass-through is typically faster, more complete and more uniform in these countries. Moreover, Sander and Kleimeier (2005) show that the differences in the pass-through, i.e. in the price stickiness of retail interest rates can largely be explained by variables describing the state of competition and the relative importance of foreign bank participation in these countries. In other word, if these countries would manage to achieve similar market structures, the pass-through would also convergence. This result stands in sharp contrast to the results for the old EMU-members, where initial market characteristics are going a long way to prevent convergence and foreign participation at a large scale.
3.4. Evidence from product availability, efficiency, and market concentration measures of integration

As discussed above, the European Commission (2005b) considers additional measures in order to obtain a broader and more complete picture of European integration. Their first set of proxies focuses on product availability (access) and measures the available product range, the ease of access (e.g. through different distribution channels) and the quality of product information. A second set of proxies focuses on efficiency and market concentration and measures to what extent integration has created intra-market competition between banks. An integrated market could be expected to move towards efficiency convergence and the same level of concentration within and across national markets.

The first impression regarding concentration was already given by Table 2 and Figure 3 which reveal decreasing number of banks driven by domestic mergers. Furthermore, information regarding the ease of access can be found in Figure 8 which shows overall reduced cost of cross-border transfers. The European Commission (2004) perceives additional consumer benefits from new services such as the use of ATMs for a growing number of operations or development of home banking. This stands however in contrast to the constant or in some countries even increasing fees paid by customers for domestic services. Here in particular Dutch and British competition authorities are concerned about the lack of competition in retail banking. Overall, Figure 16 reveals that retail bank customers benefit only moderately from efficiency while facing higher market power of banks and thus increasing prices.

Figure 16
Efficiency and concentration in European financial market

Source: Figure provided on page 50 of the background document to the 2004 Financial Integration Monitor, European Commission (2005b).
In as far as competition leads to a reduction in margins, a look at price-based studies and here in particularly those focusing on margins is useful. Note that margins offer a better understanding of the (impact of the) integration process than retail rate levels in periods when market interest rate are converging due to a reduction and final elimination of the exchange rate risks in a monetary union. Only under the condition of a monetary union, both approaches are equivalent. Figures 17 illustrates that margins are somewhat converging as reported by Cabral et al. (2002), Freixas (2003), or Baele et al. (2004). Nevertheless the significant differences remaining across countries point to the fragmented nature of retail markets.

Figure 17
Cross-country divergence of eurozone interest rate margins

Panel A: Loans to corporations

Panel C: Time deposits

Panel B: Loans to households

Source: Charts 24a to 24c of Baele et al. (2004). The figure represents the cross-country standard deviation of bank loan and deposit margins. Margins are calculated as the retail interest rate minus the 10-year government bond yield or the 3-months money market rate, respectively for long- and short-term retail rates.

Consider also Figure 18 where it can be clearly seen that convergence did not only take place within the euro zone but also on a global level. Attributing the observed convergence in the euro zone fully to European integration efforts would thus be misleading. Kleimeier and Sander (2005) therefore advocate an alternative difference-in-differences (DD) approach which avoids the mistake of over-identifying euro-zone convergence and provides results for
Figure 18
Global convergence of interest rates on retail loans

![Graph showing global convergence of interest rates on retail loans](image)

Source: Based on data provided in Kleimeier and Sander (2005). The data represents the standard deviation among interest rates of euro-zone and non-euro zone countries. The non-euro zone includes Australia, Canada, Japan, Switzerland, United Kingdom, United States of America.

euro-zone convergence that can truly be attributed to the European integration efforts rather than being part of a global integration process. Furthermore recall that much of the euro zone-specific σ-convergence takes place in the pre-EMU period which led us to conclude that progressively disappearing exchange rate risks prior to the introduction of the single currency are an important driving factor. Thus, only by looking on lending margins we can obtain evidence whether convergence in the pre-EMU period can somehow be related to the impact of an integration process. Figure 19 illustrates the results of the DD analysis provided by Kleimeier and Sander (2005). Contrasting the euro-zone with the non-euro zone mortgage margins reveals that σ-convergence is much stronger globally in the pre-EMU period. As such no euro-zone specific σ-convergence can be found. This stands in contrast to the mortgage-rate level results where about 50% of the σ-convergence was found to be euro-zone specific. This difference between rates and margins strongly suggests that the driving forces of retail rate convergence were of macro-economic rather than micro-economic nature. However, the β-convergence results for euro-zone mortgage margins reveal a convergence process that is present over the whole investigation period and is even increasing in the EMU
period. However, non-euro zone $\beta$-convergence is about twice as high. Thus compared to a global benchmark, euro-zone mortgage margins exhibit relatively less $\beta$-convergence (rather than more as might be concluded when looking at mortgage rates). This result might therefore indicate that convergence of margins is not so much driven by euro zone-specific processes such as measures to promote a single banking market, but by a global process of financial innovation and competition.

Regarding corporate loan margins, the results reveal euro zone-specific $\sigma$- and $\beta$-convergence only in the pre-EMU period. In contrast to corporate loan rates, however, the estimated coefficients are far less negative, indicating less convergence. As such, part of the observed convergence in interest rate levels is again likely to be due to the elimination of exchange rate uncertainty and overall falling interest rate levels. This interpretation is confirmed when looking at Panel B of Figure 9 where rates appear to converge only slightly and then only for a subgroup of euro-zone countries. Note that after 1998, $\beta$-convergence could also be observed for the non-euro zone, while for $\sigma$-convergence even some divergence is visible. Since the graphical picture reveals the existence of a convergence-club for corporate loans, we also conducted the analysis for a restricted euro zone excluding Germany, Belgium and Ireland. Interestingly, for these countries, both corporate rates and corporate rate margin are continuing to converge under the single currency on both measures.

The results of Kleimeier and Sander’s (2005) case study of the mortgage and short-term corporate loan markets thus indicate that most of the convergence took place before 1999. The comparison of rates and margins strongly suggests that the driving forces of integration were macro-economic factors such as the integration of money markets which were taking place in anticipation of the single currency. Simple euro zone-only results of $\sigma$- and $\beta$-convergence might indeed paint the picture of convergence but only a fraction of this convergence is euro zone-specific. Further convergence of margins did not occur under the single currency, and if it occurred – such as $\beta$-convergence of mortgage margins – it may rather be attributed to a change in the global competitive environment. Thus, the results from the DD-analysis are somewhat in line with the evidence from quantity-based measures of integration, which paint a more pessimistic picture of the state of European retail banking market integration than simple convergence studies. However, we could also document the existence of a convergence-club subgroup in the corporate loan market. This particular phenomenon suggests that further in-depth studies of determinants of convergence might be needed.

4. Conclusions

European retail banking market integration is still far from perfect and may well never become perfect. The theoretical benchmark for integrated markets, the law of one price will – at most – hold approximately for markets with traded and homogeneous products. The European retail banking markets are, however, still characterized by largely non-traded heterogeneous products. In particular, the law of one price is unlikely to hold for four reasons (see Dermine 2002): First, trust and confidence are important considerations for a retail customer when choosing a bank. Therefore, knowledge of the bank and national legal system will create differentiated banking products. Second, as retail customers are known to buy a set of financial services from the bank rather than an individual service, the law of one price might only hold for this set of services but not for each individual service. Third, classic finance theory starting with Diamond (1984) has stressed the importance of asymmetric information. To the extent that local or national knowledge reduces this information
Figure 19
Benchmarking euro-zone margin-convergence against global margin-convergence

Panel A: $\sigma$-convergence

Panel B: $\beta$-convergence

Source: Based on data provided in table 1 of Kleimeier and Sander (2005).
asymmetry, local lenders might have an advantage over foreign lenders. Finally, the law of one price assumes the absence of transportation costs and regulatory barriers. All this might argue against the emergence of an integrated retail banking industry on both a global and European level (see Berger 2003). In particular retail services, such as relationship lending to small businesses might always be provided by local banks who best understand the local market, language, or culture and who have superior information about local businesses. In the new EU member states the situation is completely different as no competitive national banking system was present at the time when the transition process started. Thus, foreign bank participation became a vital part of financial sector transformation process. Consequently, it is not so surprising that M&As in the European banking industry are often heavily influenced or even driven by considerations revolving around the financial markets of the new member states.

The still segmented markets provide diversification opportunities for the bank’s loan portfolio as risk and return differ across national banking markets, although some integration and convergence of retail interest rates is documented. All in all, the above analyses suggest that the convergence and integration process so far observed in euro-zone retail markets is, largely driven by wholesale market integration. Two mechanisms are eventually the most relevant ones: the transmission of monetary impulses onto retail banking (lending) interest rates and the trend towards a well-functioning euro-zone secondary market for loans. With respect to the first mechanism, competition and competition policy in national markets remains an issue of high importance as price stickiness is an important feature of European retail banking. As the pass-through would become faster and more homogeneous across countries this would create a de-facto integrated market. The same is true with respect to the second issue of emerging and fast developing secondary credit markets. In this area European financial regulation will have to play an increasingly important role in the future.

Finally and very recently one can observe an increase in cross-border banking. Some larger M&As have taken place and more are expected to follow. The model of the Societas Europaea and the related trend towards cross-border branching requires particular regulatory attention. In this respect Dermine (2005) warns not to “put the cart before the horse”, i.e. he urges to solve the regulatory issues of who will supervise and who will provide deposit insurance now and not when an integrated market has already emerged. He argues that the “home country” principle which in the past was functional in promoting banking market integration may in the future not be the first-best solution for guaranteeing both efficiency and stability of an integrated European banking market.
References


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Appendix

**BOX 1: CONVERGENCE METHODOLOGY**

To analyze convergence in its simplest form, the following two regressions for $\sigma$- and $\beta$-convergence can be estimated:

\[
(1.1) \quad SD_t = a_1 + b_1 T + \varepsilon_t \\
(1.2) \quad \Delta z_{c,r,t+12} = d_1 z_{c,r,t} + \varepsilon_{c,r,t}
\]

In equation (1.1) $T$ indicates a trend. In equation (1.2) $z_{c,r,t}$ is defined as the difference in month $t$ between the retail interest rate of country $c$ and the average retail interest rate or margin in region $r$ to which country $c$ belongs. The change in this deviation is measured by $\Delta z_{c,r,t+12} = z_{c,r,t+12} - z_{c,r,t}$. $\Delta z_{c,r,t+12}$ indicates the change over the coming 12 months.

In order to investigate whether convergence continued or even increased under the single currency, dummies can be included in the $\sigma$- and $\beta$-convergence regressions respectively such that

\[
(1.3) \quad SD_t = a_1 + a_2 DEMU + b_1 T + b_2 T DEMU + \varepsilon_t \\
(1.4) \quad \Delta z_{c,r,t+12} = d_1 z_{c,r,t} + d_2 z_{c,r,t} DEMU + \varepsilon_{c,r,t}
\]

where $DEMU$ is the dummy equal to 1 for observations $t$ during the EMU period. A negative $b_2$ or $d_2$ coefficient indicates additional convergence during the EMU period.

To order to benchmark the convergence process in the eurozone against global trends, a DD analysis is employed based on the following panel regressions:

\[
(1.5) \quad SD_{r,t} = a_1 + a_2 DEMU + a_3 D_r + a_4 D_r EMU + b_1 T + b_2 T DEMU + b_3 T D_r + b_4 T D_r,EMU + \varepsilon_{r,EMU,t} \\
(1.6) \quad \Delta z_{c,r,t+12} = d_1 z_{c,r,t} + d_2 z_{c,r,t} DEMU + d_3 z_{c,r,t} D_r + d_4 z_{c,r,t} D_r,EMU + \varepsilon_{c,r,t}
\]

Two additional dummies are included: $D_r$ is a cross-sectional dummy equal to 1 if the dependent variable is measured for region $r =$ eurozone. $D_r,EMU$ is a compound dummy equal to 1 for region $r =$ eurozone and for observations belonging to the EMU period. As such $SD$ and $\Delta z$ are calculated for euro zone and non-euro zone countries separately. $\sigma$- and $\beta$-convergence can now be differentiated by region and period based on the estimated coefficients.

To establish that there exists a certain long-term relationship – either bilateral between national interest rates or 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 a 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 proven to be unit roots. Only then the co-integration vector can 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 $T$:

\[
\begin{align*}
\Delta L_t &= \eta_0 + \eta_1 L_{t-1} + \eta_2 \Delta L_{t-1} + \eta_3 T + \varepsilon_t \\
\Delta^2 L_t &= \eta_0 + \eta_1 \Delta L_{t-1} + \eta_2 \Delta^2 L_{t-1} + \eta_3 T + \varepsilon_t
\end{align*}
\]

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 (or in the case of bilateral cointegration the national lending rate of another country $L_{nat2,t}$):

\[
L_{nat,t} = a + b L_{EU,t} + u_t
\]

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

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

\[
\Delta \hat{u}_t = -\delta_0 \hat{u}_{t-1} + \sum_{i=1}^{4} \delta_i \Delta \hat{u}_{t-i} + \varepsilon_t
\]

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 which with 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

\[
\Delta L_{nat,t} = \lambda_0 + \lambda_1 L_{nat,t-1} + \lambda_2 L_{EU,t-1} + \sum_{i=1}^{4} \lambda_{nat_i} \Delta L_{nat,t-i} + \sum_{i=1}^{4} \lambda_{EU_i} \Delta L_{EU,t-i} + \varepsilon_t
\]

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 regression

\[
\Delta L_{nat,t} = \phi_0 + \phi_1 \hat{u}_{t-1} + \sum_{i=1}^{4} \phi_{nat_i} L_{nat,t-i} + \sum_{i=1}^{4} \phi_{EU_i} L_{EU,t-i} + \varepsilon_t
\]

The estimated coefficient \(\phi_1\) of the ECT measures the speed of adjustment. For example an estimated \(\phi_1\) 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.

Source: Kleimeier and Sander (2002).
BOX 3: PASS-THROUGH METHODOLOGY

Traditionally, the pass-through process has simply been modeled as a VAR process (Cottarelli and Kourelis, 1994):

\[
BR_{t} = \beta_{0} + \sum_{i=1}^{k^{*}} \beta_{BR,i} BR_{t-i} + \beta_{1} M_{t} + \sum_{i=1}^{n^{*}} \beta_{M,i} M_{t-i} + \varepsilon_{t}
\]

where \( BR_{t} \) and \( M_{t} \) are lending and market rates, respectively, and \( k^{*} \) and \( n^{*} \) indicate the optimal lag lengths. Note that whenever an optimal lag length has to be determined, the minimum AIC criterion is used allowing for a maximum of four lags. However, it is important to recognize that the time series for interest rates typically exhibit an I(1) property. In this case, the empirical pass-through model is best estimated using first differences:

\[
\Delta BR_{t} = \sum_{i=1}^{k^{*}} \beta_{BR,i} \Delta BR_{t-i} + \beta_{1} \Delta M_{t} + \sum_{i=1}^{n^{*}} \beta_{M,i} \Delta M_{t-i} + \varepsilon_{t}
\]

This specification avoids spurious regression problems but leads to a loss of information about long-run relationships. Fortunately, this information can be recovered if \( BR \) and \( M \) are cointegrated. The VAR then needs to be augmented by an (lagged) error correction term (ECT):

\[
\Delta BR_{t} = \sum_{i=1}^{k^{*}} \beta_{BR,i} \Delta BR_{t-i} + \beta_{1} \Delta M_{t} + \sum_{i=1}^{n^{*}} \beta_{M,i} \Delta M_{t-i} + \beta_{ECT} ECT_{t-1} + \varepsilon_{t}
\]

The ECT measures the deviation from the long-run equilibrium, which can be obtained from the estimated error of the cointegration regression:

\[
BR_{t} = \theta_{0} + \theta M_{t} + u_{t}
\]

The appropriate version of the pass-through model as either equation (3.1), (3.2), or (3.3) depends on the time series and cointegration properties of the interest rate series. In all specifications, the impact multiplier is estimated by the coefficient \( \beta_{1} \). A value of less than 1 indicates sluggish adjustment, also known as lending rate stickiness. The long-run relationship between market rates and retail rates is given by equation (3.4) and can be interpreted either as a cointegration relationship or as the long-run solution of the VAR. The long-term multiplier \( \theta \) can be directly obtained from estimating equation (3.4) if the rates are cointegrated. Otherwise, the long-term multiplier has to be calculated from (3.1) or (3.2) as:

\[
\theta = \frac{\beta_{1} + \sum_{i=1}^{n^{*}} \beta_{M,i}}{1 - \sum_{i=1}^{k^{*}} \beta_{BR,i}}
\]

A full pass-through in the long run is reflected by \( \theta=1 \). An imperfect pass-through (\( \theta<1 \)) could be caused by a less than perfect elasticity of demand for banking products, the existence of market power, a lack of market contestability, switching costs, or information
asymmetries. If the long-run pass-through is found to be overshooting ($\theta > 1$) in lending markets, this can be interpreted as a situation where banks increase lending rates to compensate for higher risks instead of rationing credit.

Given the major developments in the Eurozone since 1992, the long-run relationship may be subject to structural changes. Instead of exogenously postulating a break point and then test for its presence, the presence and timing of the break can be determined endogenously by estimating a supremum $F$ ($\text{sup}F$) test for equation (3.4). This test can be interpreted as a rolling test where standard Chow tests are conducted for a series of different break points, which move through the mid-80% of the sample period. For details on this test see Andrews (1993), Diebold and Chen (1996), Hansen (1992). $\text{Sup}F$ equals the largest Chow $F$-statistic and is compared to critical values as reported by Hansen (1992). On the base of these tests pre- and post-break periods can be constructed for every national retail interest rate. This allows the researcher to obtain additional information on the timing of structural changes and to estimate pass-through models for break-free sample periods.

While most pass-through studies focus on symmetric adjustment toward the long-run equilibrium, Sander and Kleimeier (2002) advocate that threshold and asymmetric adjustment mechanisms should both be considered for two main reasons: First, retail rate adjustment patterns in the eurozone are indeed frequently either asymmetric or occur only beyond a certain threshold. Thus, they should not be ignored. Second, using models with asymmetries allows us to detect cointegration in cases where there are asymmetries and where other methods would thus fail to detect cointegration and wrongly re-direct the researcher to the pass-through model of equation (3.2).

Five asymmetric specifications for the adjustment of interest rates are considered. Consider first the symmetric pass-through model. Here the ECT is defined as

\begin{equation}
(3.6) \quad \text{ECT}_{t-1} = u_{t-1}
\end{equation}

and cointegration testing is based on the Durbin-Watson (DW), Dickey-Fuller (DF) and augmented Dickey-Fuller (ADF) tests. As the first asymmetric model, consider the threshold autoregressive model (TAR$^b$) developed by Tong (1983). The model distinguishes whether the explained interest rate is above or below its equilibrium level. Thus, the TAR$^b$ allows for asymmetric adjustment depending on the sign of the equilibrium deviation. For example, if the money market rate decreases without an immediate adjustment of the lending rate, we obtain a positive realization of the error term $u_t$. When in this case the autoregressive decay is faster than in the case of money market rate increases, the lending rate adjustment is faster downward than upward. For this TAR$^b$ model, the ECT is defined as

\begin{equation}
(3.7) \quad \text{ECT}_{t-1} = I_t u_{t-1} + (1 - I_t) u_{t-1}
\end{equation}

where $I_t$ represents a Heaviside indicator for different states of $u_{t-1}$ such that

\begin{equation}
(3.8) \quad I_t = \begin{cases} 
1 & \text{if} \quad u_{t-1} \geq 0 \\
0 & \text{if} \quad u_{t-1} < 0
\end{cases}
\end{equation}

Using this definition we estimate equation (3.9):

\begin{equation}
(3.9) \quad \Delta u_t = I_t \rho_1 u_{t-1} + (1 - I_t) \rho_2 u_{t-1} + \sum_{i=1}^{m^*} \rho_{2,i} \Delta u_{t-i} + \varepsilon_t
\end{equation}
Cointegration testing takes the form of a modified ADF test. The null of no cointegration is rejected if the estimated F-statistic for \( H_0: \rho_1 = \rho_2 = 0 \) is statistically significant based on critical values provided by Enders and Siklos (2000). If cointegration is established, an F-test for \( H_0: \rho_1 = \rho_2 \) indicates the presence of asymmetry.

The second asymmetric model (TAR*) is a modification of the TAR\(^0\) in the sense that the threshold is now allowed to deviate from zero. The rationale is that retail rates may adjust differently to a disequilibrium once a certain minimum deviation in one direction is exceeded. For the TAR* model, the Heaviside indicator in conjunction with equation (3.7) is defined as

\[
I_t = \begin{cases} 
1 & \text{if } u_{t-1} \geq a_0^* \\
0 & \text{if } u_{t-1} < a_0^* 
\end{cases}
\]

Following Chan (1993), the optimal threshold \( a_0^* \) is found by searching over the mid-80% of the distribution of \( u_t \) and selecting the model for which the residual sum of squares is minimized. For both, the TAR* and the following B-TAR* model, the optimal lag length \( m^* \) of the TAR\(^0\) specification is used. Cointegration and asymmetry testing proceeds with the above-described F-tests.

The third variation is a Band-TAR model (B-TAR*), which can reflect both interest rate stickiness, driven by menu-cost behavior of banks, as well as interest rate smoothing. For example, menu-cost behavior could be relevant if cointegration is found only outside a band bordered by \( a_0^* \) and \(-a_0^*\). For the B-TAR* model, the Heaviside indicator in conjunction with equation (3.7) is now defined as

\[
I_{jt} = \begin{cases} 
I_{1t} = 1 & \text{if } u_{t-1} \geq a_0^* \quad \text{and } 0 \quad \text{otherwise} \\
I_{2t} = 1 & \text{if } |u_{t-1}| < a_0^* \quad \text{and } 0 \quad \text{otherwise} \\
I_{3t} = 1 & \text{if } u_{t-1} \leq -a_0^* \quad \text{and } 0 \quad \text{otherwise} 
\end{cases}
\]

while equation (3.9) is modified to

\[
\Delta u_t = I_{1t}\rho_1 u_{t-1} + I_{2t}\rho_2 u_{t-1} + I_{3t}\rho_3 u_{t-1} + \sum_{i=1}^{m^*} \rho_{3i}\Delta u_{t-i} + \varepsilon_t
\]

The F-tests for cointegration and asymmetry are now applied to all three coefficients \( \rho_j \).

Finally, the fourth and fifth asymmetric models represent momentum threshold autoregressive (M-TAR) models. In the TAR models the autoregressive decay always depends on the degree of deviation from equilibrium. In contrast, in the M-TAR approach the adjustment speed depends on how fast the rates move away from or towards equilibrium. As such, M-TAR adjustment can reflect behavior by banks, which attempt to smooth out large market rate changes. In this case, the Heaviside indicator depends on the change in the error correction term \( \Delta u_t \) such that

\[
I_t = \begin{cases} 
1 & \text{if } \Delta u_{t-1} \geq a_0 \\
0 & \text{if } \Delta u_{t-1} < a_0 
\end{cases}
\]

The ECT is defined accordingly. The optimal lag length of the M-TAR\(^0\) model is used for the M-TAR* model. In a manner similar to the TAR\(^0\) and TAR* specifications, M-TAR models can either be estimated with a threshold \( a_0 = 0 \) leading to the M-TAR\(^0\) specification or can be optimized at \( a_0 = a_0^* > 0 \) leading to the M-TAR* specification.
The objective of this methodology is to obtain the optimal pass-through model rather than arbitrarily selecting one. As such, break-free sub-periods are identified. Then one proceeds with unit root testing. If the rates are I(0), the pass-through model is estimated as in equation (3.1). If the rates are I(1), all five asymmetric TAR-type models are estimated, the best asymmetric model is selected based on the AIC criterion, and this best model is tested for asymmetric cointegration. If asymmetric cointegration is confirmed, the pass-through model is estimated as in equation (3.3) with the appropriate asymmetric ECT. If asymmetric cointegration is rejected, symmetric cointegration testing is required and – if confirmed – symmetric ECT is included in the pass-through model of equation (3.3). If symmetric cointegration is also rejected, the pass-through model is estimated according to equation (3.2) without any ECT. Finally, based on the selected pass-through model multipliers can be obtained for a variety of positive and negative interest rate shocks.