London Metropolitan University

An Empirical Analysis of European Retail Banking Integration

Aarti-Kiran Rughoo

London Metropolitan Business School

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Abstract

The aim of this thesis is to examine whether any integration has taken place within the European Union retail banking sector during the period 1990-2008 by analysing both macro and micro data for the 15 European Union countries. The macro-data analysis is performed on 19 sets of various monthly retail deposit and lending rates to the two components of retail banking, i.e. households and non-financial corporations. The micro-data analysis is performed on European retail banks' cost efficiency (cost-income ratios and cost efficiency scores), and profitability (return on asset) data. An important contribution of this thesis is the application of methodologies which have not hitherto been employed in this area. First, cointegration analysis is performed on various deposit and lending data time series. Second, the deposit and lending spread data series are tested for structural breaks and the effects of these breaks are then removed by demeaning each individual spread data series. Third, while allowing for structural breaks, panel unit root tests are applied to all the interest spread data. Fourth, the recently developed Phillips and Sul (2007) panel convergence test is applied to both the macro and micro data to analyse the degree as well as the speed of convergence. In addition, this convergence test identifies the presence of club formation, if present, and also measures the behaviour of each country's transition path relative to the panel average. This thesis also carries an extensive analysis of the regulatory environment in the European banking sector.

The stochastic structural break tests reveal the presence of structural breaks in all the spread data series and show that the break dates are closely clustered and match key events in the history of the European banking sector. The results on integration depend crucially on which methodology and data is employed. In particular, the findings point

to a more heterogeneous consumer credit market compared to the household deposit and mortgage market and the deposit and lending market to non-financial corporations. For several categories of interest rate data, the maturity duration is inversely related to the convergence process, with instruments with longer maturity typically showing more diverse behaviour. With regards to the cost efficiency and profitability of European retail banks, convergence is detected at cluster level rather than at group level. However, a decrease in the heterogeneity displayed among the 15 EU countries is noticeable, especially towards the end of the 1990s.

Chapter 1

Introduction

Prior to the Single European Programme (SEP), the banking sector in many European Union (EU) countries was often anti-competitive with entry restrictions against foreign banks and highly segmented with the functional separation of institutions. The SEP had the important objective of shifting the strategic mindset of the EU banks from a collusive and protective environment to a more liberalised market. These goals were channelled through the adoption of banking Directives, like the Second Banking Coordination Directive in 1993 which establishes the principle of a single licence for banks. Over the years, in order to enable banks to compete on equal terms within a sound regulatory framework, several other measures such as the Financial Services Action Plan, supplemented the Second Banking Directive and on many occasions, these have been revised and recast. To-date, in line with the objectives of establishing a single market in financial services or indeed, as emphasised by the Lisbon European Council in March 2000, in order to turn the EU into "the most competitive economy in the world by 2010", the European banking sector has also undergone important regulatory and structural developments. Consequently, pundits unanimously agree that significant progress has been achieved towards integrating the financial services market in Europe.

1.1 Conceptual framework of banking integration

With regards to the banking sector, the concept of perfect integration is generally understood to refer to the absence of barriers of any kind to cross-border transactions, heightened competition and generally closer market linkages. However, an important consideration here is the issue of segmentation in banking which takes the form of asymmetric information, a diverse range of products, the importance of proximity and bank-client relationship and cultural factors. Hence, in view of the specific attributes of the banking industry which make segmentation an inherent part of the sector, perfect banking integration can be construed as being synonymous to a state free of physical barriers across borders while co-existing with non-physical barriers such as banks' reputation and trust. Furthermore, as argued by Brouwer (1999), integration is a process whereby segmented markets become unified and open and where participants enjoy unhindered access to services and products. Banking integration would therefore relate to a market whereby i) transactions are free flowing, ii) there is a high rate of capital flows and iii) there is a tendency for prices and returns on financial assets to converge. In this thesis, the definition put forward by Brouwer on financial integration is extended and investigated. Hence, the process of banking integration is assessed by analysing the degree and speed of convergence in banking products' prices, in their returns as well as in their cost ratios. The implication being that convergence should be viewed as a long run relationship rather than the rigid application of the law of one price.

1.2 Motivation

The main motivation of this thesis is to conduct an empirical analysis of the convergence process in European retail banking sector by investigating both macro and micro data for the period 1990-2008. The macro data analysis focuses on retail banks' products pricing, i.e. various retail deposit and lending rates to households and non-financial institutions while the micro-data analysis investigates retail banks' cost efficiency measures and profitability. The objective behind this multi-faceted approach is to add to the existing literature on European retail banking literature by conducting a robust and thorough investigation. So far, there is relatively a large amount of literature on integration in the European wholesale money and bond market while fewer studies have tried to estimate the degree of European retail banking sector, more specifically in the traditional lending and deposit activities such as consumer credit, savings deposits, residential mortgages, small and medium sized commercial deposits and loans.

The limitations identified in these latter studies are as follows. Firstly, none of these studies, except for one[1], takes into consideration the impact of structural breaks. Given the frequency and importance of the legislative overhaul in the European Union banking sector, interest rate data, notably deposit or lending spread data[2] is bound to exhibit a number of shocks. Furthermore, as well documented in the literature, if the effects of structural change are not accounted for, it could lead to wrong inferences being drawn from results obtained. This thesis employs a powerful multiple break model to detect structural breaks in deposit and lending spreads and adopts a consistent procedure to remove the effects of these breaks. In addition, an analysis of the pattern of the break occurrences should provide further insight into the retail banking integration process. Secondly, several of these studies use a limited data set which again may bias the results. This thesis constructs an extensive data base on

[1] Sander and Kleimeier (2000) do test for structural breaks but do not follow a rigorous methodology in factoring in these breaks except for splitting the data sample into two periods and removing the years in which the breaks are most common.

[2] Calculated as the difference between each deposit or lending data series and the corresponding European weighted average.

interest rates starting in 1991 and up to December 2008. The data sets are further classified according to varying maturity structures in order to produce reliable estimates. Given that the time span covers both the 1990s and the more recent period, 2003-2008, a comparison of the integration process between the 1990s and the new millennium is possible. Thirdly, most of the existing studies rely on time series analysis which may at times lack power. This thesis employs both time series and recently developed panel convergence methodologies to analyse the retail banking sector. Notably, the Phillips and Sul (2007) powerful convergence test, which has not previously been employed in this area, is applied to both the macro and micro retail banking data. This methodology brings a novel insight into the study of retail banking integration as it identifies both the degree and the speed of convergence. In addition, it also detects the presence of club convergence among different sub-clusters of countries. Fourthly, existing studies investigate mostly the consumer or corporate lending market while the savings market is not always part of the analysis, except in some earlier studies wherein the sample period typically stops in 2000. This thesis applies convergence methodologies to deposit and lending rates to both components of the retail sector, i.e. households and non-financial corporations, i.e. small and medium enterprises. Fifthly, regarding the analysis of micro-data, so far there is only a couple of studies that investigate convergence in banks' efficiency and profitability. This thesis therefore contributes to this branch of literature by providing an updated analysis as well as the use of more powerful panel convergence models.

1.3 Structure of the thesis

The thesis is organised as follows. Chapter 2 reviews the literature on European banking integration and highlights the gaps in the existing literature. This makes the motivation behind this research much clearer and also provides justification for the methodologies chosen in this thesis.

Chapter 3 provides an extensive review and analysis of the legislative changes in the history of the European banking sector. Many of these regulatory changes have been pivotal in the pursuit of a single market in banking. In particular, the developments on two key directives, namely on deposit guarantee schemes and capital requirements respectively are analysed in greater detail. The recent financial crisis has revealed serious gaps in existing legislations. Therefore this specific analysis attempts to evaluate the role played by the two existing directives. Chapter 3 also notes that very often progress in implementing regulatory changes within the European banking sector can be slow or Member States sometimes incorrectly transpose or misapply certain provisions from directives. On the whole, an understanding of these banking directives and other initiatives discussed in Chapter 3 is fundamental for the discussion in the following Chapters.

Chapter 4 introduces and discusses the econometric methodologies chosen for the empirical analysis of the degree and speed of European retail banking integration. This thesis adopts the view that convergence in banking is synonymous to long-run equilibrium. Consequently, times series Johansen (1988) cointegration test; the Im, Pesaran and Shin (2003) and the Pesaran (2007) panel unit root tests; and the recently developed Philips and Sul (2007) panel convergence model are applied to household and non-financial corporations deposit and lending rates spanning the period 1991 to 2008. In all, 19 datasets have been constructed for each of the 15 group of EU countries[3] in the sample. The data have been sourced from the ECB database. The Bai and Perron (1998) stochastic multiple structural break model is also applied to deposit and lending spread data series before employing the panel unit root methodologies. This thesis is the first to factor in the effects of structural breaks and also the first one to apply these specific panel methodologies to the European retail banking area. In addition, the advantages of the Phillips and Sul (2007) tests are numerous. Firstly, the model is based on a time-varying parameter with no specific requirements on stationarity. Secondly, this model also allows for individual heterogeneity and is more informative than other convergence tests. Given the often cited argument that the European retail banking sector is heterogeneous in nature, the use of the Phillips and Sul methodology brings a novel and deeper insight in this area. In particular, it provides information on the degree and speed of convergence as well as identifies whether club convergence within a larger panel group is taking place. This convergence test also allows the monitoring of the behaviour of the time paths for each individual country in the sample vis-à-vis the panel cross-section average.

Chapter 5 provides a detailed empirical analysis of the convergence process in retail banking to the household sector by analysing consumer credit, mortgage and deposit rates with varying maturities for 2 periods; 1991 to 2002 and 2003 to 2008, thus enabling a comparison between the 1990s and the new millennium. Before running

[3] Due to lack of interest rate data for the other EU countries, the focus of the analysis is limited to Austria, Belgium, Germany,Denmark, Finland, France, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, UK.

the Johansen cointegration tests, the ADF unit root tests are applied to check whether the data is stationary. Thereafter, cointegration tests are run for each individual series against a constructed weighted European average. In addition, it is the first time that the break dates in the household interest rate spread data series are identified and the effects removed by demeaning each individual spread data series. The patterns in the break dates are also analysed in depth in line with the discussion presented in Chapter 3. Subsequently, the panel unit root tests are run on both the original and demeaned spread data sets. Before applying the Phillips and Sul convergence test, the Hodrick-Prescott Filter is employed in order to remove the cycle component in the data. The application of the Phillips and Sul model yields results on the degree and speed of overall group convergence, if present. In addition, the presence of club convergence as well as the speed of convergence within these sub-clusters are identified. The time paths for the individual countries for each data set are also illustrated and analysed. In brief, the cointegration tests results, panel unit root test results and the Phillips and Sul convergence test results are interpreted, analysed and reconciled.

Chapter 6 conducts a similar analysis as in Chapter 5 on deposit and lending rates to non-financial corporations, the second component of retail banking. The similarities and differences in the results obtained for the household sector and for non-financial corporations are also highlighted.

In Chapter 7, the focus of the empirical investigation moves to micro-data analysis. This Chapter is the first study that employs the Phillips and Sul convergence model to European retail banks' cost efficiency (cost-income ratios and efficiency scores[4]) and

[4] The Phillips and Sul model is also applied to cost-efficiency scores computed by Weill (2009).

profitability data (ROA), which have been calculated from data obtained from the OECD database. The time span covered is from 1990 to 2008 and matches the periods covered in Chapters 5 and 6. The objective here is to analyse whether the harmonisation process in the European Union and resulting competitive pressures have led to convergence in retail banks' returns and cost efficiencies. Hence this investigation on retail banking integration is conducted through another pivotal angle and complements the analysis in Chapters 5 and 6. To-date there is only the study by Weills (2009) that tests for convergence in European banks' cost efficiency but he employs a different convergence methodology. As for estimating convergence in European banks' profitability, the study by Gropp and Kashyap (2009) uses a ad-hoc partial adjustment specification model. In Chapter 7, the argument is put forward that the Phillips and Sul convergence methodology is superior to these methods. Chapter 7 also includes a comparative analysis of the results obtained under the different banking ratios.

Chapter 8 summarises the main findings of this thesis, discusses the implications for future policy and sets out future research work.

Chapter Two

Literature review

2.1 Introduction

The banking literature reveals that the degree of integration in the financial markets can be assessed by using a number of alternative tests. These tests can range from simple quantitative flow analysis such as the volumes of cross-border flows or the share of foreign banks, to more complex econometric methodologies which investigate convergence among various financial asset prices, such as interest rate, bond yields, savings rates, etc. Most studies[1] test for integration in the wholesale money and bond markets. So far, fewer studies[2] have tried to estimate the degree of integration in retail banking, more specifically in the traditional lending and deposit activities to households and small and medium enterprises such as consumer credit, residential mortgages, small and medium sized commercial loans and demand and savings deposits.

This chapter is organised as follows. Section 2.2 discusses the theoretical underpinnings on the determination of interest rates. Section 2.3 reviews the main findings from the earlier literature (mostly around the 1990s) on the studies on European money and banking market integration. Section 2.4 focuses on the more recent literature on the European retail banking integration while section 2.5 concludes with a discussion of the limitations of the existing studies.

[1] Holmes and Pentecost (1995), Lemmen (1996), Alexakis et al (1997), Adam et al (2002), Cabral et al (2002) and others.

2.2 Interest rates: a theoretical perspective

There are several economic viewpoints which discuss the determination of interest rates in the financial market. One theory builds on the model of money market whereby the rate of interest is considered to be the price of money and therefore determined by the demand and supply of money. Another approach is the loanable funds theory which argues that interest rates are determined by the interaction of demand and supply of loanable funds or financial assets. This approach considers factors behind the demand and supply of loanable funds, such as expectations of future income, market confidence, the level of savings, etc, as the key determinants of interest rates movements. However, these two approaches are simplified models which do not take into consideration the variety of interest rates in the market depending on the duration of the loan or credit worthiness of the borrower or default and liquidity risks. In addition, there are other factors that influence interest rates such as the credibility of a government's macroeconomic policies, the rate of economic growth, inflationary expectations, risk perceptions and others. As a result, the structure of interest rates differs and so do the yields on various instruments which would lead to a variety of possible yield curves. A number of theories, namely the expectations theory, the liquidity preference theory, the preferred habitat theory and the market segmentation theory try to explain the shape of yield curves and hence the relationship between short-term and long term interest rates (Pilbeam, 2010; Howells and Bain, 2007).

According to the expectations theory, long-term interest rates are determined by market expectations about the trajectory of future short-term interest rates and inflation rates. Hence, an upward sloping yield curve, for example, would imply that the market

[2] Centeno and Mello (1999), Kleimeier and Sander (2000, 2003, 2006), Schuler and Heinemann

expects short-term interest rates to rise whereas a flat yield curve would imply that the market expects short-term interest rates to remain constant in the future. However, in reality, the estimates on future short-term interest rates are likely to be subject to errors and uncertainties, especially if the projections are for longer time periods. According to the liquidity preference theory, investors tend to be risk-averse and must be compensated with a premium for the higher risk involved. Therefore, the yield on the interest rate will not only reflect the market expectations but also a liquidity premium. As a consequence, the size of the liquidity premium increases with the time duration of the interest rate instrument. The preferred habitat theory, on its part, puts forward the view that different groups of savers have definite investment objectives and preferences as to where to invest their money. Consequently, if most investors have a specific preferred habitat, for example five year long investments, then short-term and longer term interest rates may be higher to attract investors. The market segmentation theory embraces the assumption that investors have preferred habitats but also assume that barriers such as regulatory requirements and transaction costs prevent investors from moving funds in between short, medium and long term investments (Pilbeam, 2010; Howells and Bain, 2007).

As highlighted above in the discussion of the different theories on the term structure of interest rates, there are various factors that can influence and determine interest rates. An understanding of the theoretical underpinnings on the relationship between short-term and long term interest rates is central to the discussion that follows in Chapters 5 and 6.

(2002a,b), Vajanne (2007)

2.3 Studies on the European money and banking market integration

The link between interest rate equalisation and financial integration in the context of Europe has spurred quite considerable attention since the 1980s. The establishment of the Single market with the free movement of goods and services has created the ideal setting to test for interest parity within the EU. Furthermore, it is expected that the removal of capital controls and the emergence of a single currency should gradually make real money market rates converge across the EU. Most studies, dating from the 1980s, test for banking integration within the United States rather than within Europe. However, by the start of the 1990s, the application of interest parity tests to EMS countries started emerging. It seemed to have started with the study of Karfakis and Moschos (1990) who test for long run interest linkages between Germany and 6 other EMS countries[3] by using cointegration bivariate analysis. They use 3-months and 6-month yields on treasury bills and 3-month loans data for the period 1979 to 1988. Their results do not indicate any systematic long run interest rate relationship between Germany and the EMS countries. Later, in 1993 Katsibris and Miller, attempt to improve on Karfakis and Moschos's methodology by introducing a third variable in the analysis (the U.S. interest rate) to tackle spurious findings. They test for bivariate cointegration between the German/U.S. interest rate and other EMS countries. They use the same data and cover the same period as Karfakis and Moschos. Surprisingly, the findings reveal stronger cointegration between the U.S. and EMS rates rather than with the German rate.

[3] Belgium, France, Germany, Ireland, Italy and Netherlands.

Holmes and Pentecost (1995), on their part, investigate the co-variability of changes in nominal short-term and long-term interest rates of 6 EC countries between 1973 and 1992. They use principal component analysis to test for money market integration in two sub-periods: 1974-1979 and 1979-1992. Short-term interest rates (3-month Treasury bill rates) are used in their analysis and the authors find evidence of closer co-variation in German interest rate changes with most other EC members. Later, Alexakis et al (1997) test for long run interest rate equalisation within five EMS countries[4] and four non-EMS countries[5] over the period 1982-1993. Three and six-month T-bills, deposit rates, bond yields and loan rates are used as nominal interest rates. Cointegration tests are conducted on a bivariate framework (similar to Karfakis and Moschos) and on a multivariate basis as well. The results show that real interest rates on all fronts satisfy their convergence hypothesis (based on the definition put forward by Bernard and Durlauf[6], 1996) that real interest rate differences are indeed narrowing. They find the presence of cointegration which indicates that interest rates for the EMS countries are converging towards the German rate while non-EMS countries interest rates are moving towards the U.S rate. The authors also note that their results are similar to those of Holmes and Pentecost (1995) even if the latter use a different methodology.

Hall et al (1992) develop a methodology using both cointegration and time-varying parameter (Kalman Filter technique) to test for economic (nominal and real) convergence within the EC. Exchange rate differentials, inflation differentials and interest rate differentials are tested for the period 1970-1990 for the then 12 EC countries. Results indicate that many of the core EMS interest rates have converged

[4] Germany, France, Netherlands, Italy and Belgium.
[5] U.S, Japan, Canada and Switzerland.
[6] Bernard and Durlauf define convergence as "a catching-up hypothesis"

towards the German rate. However, it is also noted that convergence of one series (exchange rates) may imply divergence of others (interest rates).

So far, all the above earlier studies rely on time series analysis to conduct an assessment of the convergence process within European money and banking markets. Beginning with the new millennium, some studies turned to panel data analysis in their estimation of European banking integration. One of them is the one by Holmes (2001), who considers covered interest parity to be the most appropriate indicator of the degree of financial integration and uses Im, Pesaran and Shin's (1997) methodology to conduct panel data unit root tests on covered interest differentials. As argued by Holmes, panel unit root tests yield higher test power than standard unit root tests. The data set from 6 EU countries and 3 non-EU countries[7] are pooled and tested for whether deviations from covered interest rate parity contain a unit root or are from a stationary series. The period covered is from 1983 to 1998 and the rates used are the monthly and 3-month treasury bill rates, euro-currency rates, spot and forward exchange rates. The results from the tests suggest that the relaxation of the capital controls in the 90s in the EU helped maintain covered interest parity.

Around the same time, a few other studies have relied on panel convergence methodologies to assess European financial integration. One of the first of such studies is the one by Murinde et al (2000) who apply the convergence concepts namely beta convergence and rho convergence[8]. These two concepts of convergence are drawn from the growth literature, to be used to model the convergence of the banking systems of (i) the Central and Eastern European economies and (ii) of the EU from 1993 to 1997.

[7] Belgium, Germany, France, Italy, Netherlands, U.K., U.S., Canada and Japan

Using the generalised methods of moments (GMM) estimator, Murinde at al (2000) derive a dynamic fixed-effects panel data model as follows:

$$g_{i,t} = \alpha + \beta_1 g_{i,t-1} + \beta_2 g_{i,t-2} + \beta_3 q_{i,0} + \varepsilon_{i,t} \tag{1}$$

Where $g_{i,t} = \ln q_{i,t} - \ln q_{i,t-1}$, the growth rate of bank output measures (loans to government sectors, public enterprises, or private sectors). $Q_{i,0}$ is the initial level of bank output measures at 1993. In line with the existing literature, Murinde et al also define a bank's output in terms of deposits: demand deposits, time and savings deposits and foreign liabilities.

Results from the tests conducted on data from 10 transition economies[9] suggest that convergence with respect to loans to the government sector can be detected for all 10 countries. As for loans to public enterprises, no convergence can be observed. This is attributed to bad debt problems inherited from the previous regime. But the results point to convergence with regards to bank loans to the private sector. Results based on the definition of a bank's output as deposits show convergence trends can be noted for demand deposits and foreign liabilities but no convergence for time and deposit savings.

The same model is applied to a bigger sample (7 transition economies[10] plus 11 EU countries[11] and results indicate no convergence for loans to government sectors, for demand deposits and for time and savings deposits. However, a tendency towards

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[8]. Beta convergence applies if a poor country grows faster than a rich one and catches up with it in terms of the level of per capita income. Sigma or rho converg ence occurs when the dispersion (such as standard deviation) declines over time (Barro and Salai-I-Martin, 1995).

[9] Azerbaijan, Croatia, Czech Republic, Estonia, Latvia, Lithuania, Poland, Russia, Slovak Republic and Ukraine.

[10] Croatia, Czech Republic, Estonia, Latvia, Lithuania, Poland and Slovak Republic.

convergence is detected for loans to the private sector and for foreign liabilities. The authors conclude that the transition economies have not converged to the EU model yet.

Another influential study in the area is the one by Adam et al (2002) who test for financial integration by considering: i) indicators for the credit and bond market, ii) indicators for the stock market, iii) indicators used in economic decisions of households and firms and iv) indicators on institutional differences in the Euro-zone. Like Murinde et al (2000), the authors use the concepts of beta (speed) and sigma (degree) convergence from the growth literature to estimate the following panel data model:

$$\triangle i_{ct} = \alpha_c + \beta i_{ct-1} + \sum_{l=1}^{L} \gamma_l \triangle i_{ct-l} + \varepsilon_{ct} \qquad (2)$$

Where c and t denote the country and time indices, $\triangle i$ is the change in the interest rate and α_c the country dummies. A negative β would mean convergence so if $\beta = 0$, then there no convergence and with sigma convergence, the degree of financial integration is said to increase as the cross-sectional standard deviation of interest rates trend downward. When the standard deviation converges to 0, full integration is achieved.

This model is used on interest differentials (1995-2001) for 4 interest rates: the inter-bank 3-month rate, the 10-year government bond benchmark yield, the mortgage rate and the corporate loan rate. Results indicate that the speed of convergence accelerates after 1999 and is highest for the interbank market rate and the bond rate and intermediate for the mortgage rate. However for the corporate loan rate, slow convergence is noted both pre and post 1999. These results are consistent with the evidence from the sigma convergence tests.

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[11] Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Portugal and UK.

2.4 Retail banking integration

One of the earliest study that has specifically investigated European retail banking integration is the one by Centeno and Mello (1999) who apply cointegration techniques to interest rates in the money market and in the commercial bank lending market in six European economies[12] for the period 1984 to 1994. Nominal interest rate for 6 months are used and the real ex-ante interest rates are calculated from the Fisher identity:

$$I^j{}_t = r^{ej}{}_t + \pi^{ej}{}_t \tag{3}$$

Where $I^j{}_t$ is the observed nominal interest rate between period t and t+1 in country J. $r^{ej}{}_t$ is the unobserved real ex-ante interest rate and $\pi^{ej}{}_t$ is the unobserved expected inflation rate

Using the Engle and Granger test, the following time series model[13] is estimated

$$r^j{}_t = \alpha + \beta r^i{}_t + \varepsilon_t \tag{4}$$

They further test for causality between German rates and rates in the other countries using an error correction model. They conclude that there is evidence that the money markets, in Europe and especially in the case of the EMS countries, are integrated. However, with respect to the bank spreads for loans, no cointegration between the

[12] Germany, United Kingdom, France, Italy, Spain and Portugal.
[13] For $r^j{}_t$ and $r^i{}_t$ to be cointegrated time series and β to be the cointegrating parameter, the residuals ε_t must be stationary and each individual time series r_t be non-stationary with a unit root. The ADF, PP and KPSS tests are conducted.

spreads is found and moreover, segmentation does not seem to have decreased over the 10 years.

Other studies look at flow-based indicators in the retail banking market in order to assess the convergence process. The European Commission (2001) analyse the dispersion of 3 interest rates (mortgage rate, time deposit rate and short-term loans to enterprises) over the period 1996-2001. Results indicate that mortgage and deposit rates have converged ahead of EMU while short term loan rates show some convergence after 2000. Along similar lines, Cabral et al (2002), using deposit and household and corporate lending rates, calculate banks' margins (difference between average lending and deposit rates) vis-à-vis market interest rates over the periods 1998-1999 and 2001-2002 for the euro area. The authors opine that margins can be used as an indicator of integration whereby a decline in margins may signify an increase in competition. For both periods investigated, the study finds that the dispersion in the banks' margins has not declined significantly. Based on these results, the authors conclude that retail banking has tended to remain local and segmented.

Dermine (2002), on his part, asserts that international integration can be analysed through three different concepts, namely the law of one price; the volume of cross-border business; and the amount of foreign direct investment and foreign market share. Dermine (2002) draws from various studies and points out that the law of one price is unlikely to hold in retail banking because banking products and services cannot be termed as being homogeneous. This is so because of factors such as i) the importance of trust and proximity in banking, ii) the competitive advantage enjoyed by local banks in providing a range of services, iii) asymmetric information in lending and iv) transportation and regulatory barriers. Moreover these factors lead to switching costs, which translate into low price elasticity, low price competition and the persistence of profits. Furthermore, factors such as the costs of cross-border transfers and interest margins on deposits do not support the law of one price in retail banking. The second indicator of integration proposed by Dermine is the flow of cross-border banking business. A significant increase is noted for Belgium, Denmark, Finland, Italy, Germany, and Spain for the period 1990-2000. Dermine considers such a trend to be promising and points out that this is attributable largely to the corporate sector. The overall results for the market share of foreign bank, on the other hand, indicate that the retail market is still very much fragmented with a low penetration of foreign banks in domestic market while the corporate/investment banking sector show much greater signs of integration.

Sander and Kleimeier (2000) test for the degree of integration in retail lending for 6 EU countries (France, Germany, UK, Netherlands, Belgium and Italy) by using a cointegration approach and corresponding error correction model. Monthly time-series data for nominal lending rates and spreads[14] are tested for the period 1985 to 1997 and cointegration analysis is performed for each country vis-à-vis a weighted average. The authors further test for structural breaks by using the supremum F test. The breaks mainly appear in the late 80s and early 90s for the money market rates and in 1993-95 for spreads. The authors do not use any specific methodology to factor in the effect of the breaks but simply eliminate the data for the years in which the breaks are most visible. The 6 EU countries are also tested as a whole vis-à-vis the US and Japan. The results show that the structure of the European banking system is changing rapidly and that convergence is occurring (results are supported by descriptive statistics). However,

[14] The lending rates refer to the national commercial bank prime lending rate. Spreads are calculated in 2 ways: 1) nominal spreads are calculated by subtracting money market rate from the lending rate, 2) relative spreads are obtained by dividing the lending rate by the money market rate.

the authors note that cointegration tests are most useful after convergence has occurred and that an analysis at a later period would prove more useful. As for the EU countries plus the US and Japan, no pattern of integration is detected.

Sander and Kleimeier (2003) later perform a similar analysis on 3 different credit instruments (mortgage loans to households, consumer loans, and lending rate charged to corporate sector) across 10 EU countries over the period 1995-2000. Cointegration analysis is conducted on the retail lending rates in both nominal and real terms. Using time series data, the authors estimate an error-correction model to test for long term integration between national and other EU rates. The data sample is divided into a pre-EMU and an EMU sub-group and the individual series are tested against a weighted European average. The authors find limited evidence of integration for nominal mortgages and consumer rates and even more sparse evidence in real terms. As regards corporate lending, stronger results for integration are reported. However, as the authors point out, their EMU sample analysis is based on data for only 3 years and, as such, need to be interpreted with caution.

Schuler and Heinemann (2002a) analyse the integration in the retail financial market, more specifically in 4 lending markets: a) mortgage loans to households, b) consumer loans to households, c) short-term loans to enterprises, d) medium and long term loans to enterprises and in 2 deposits market: a) time deposits and b) savings account. The authors use the Johansen procedure to test for bivariate and multivariate cointegration between national interest rate spreads for 11 EU countries[15]. Monthly time series data from the ECB's National Retail Interest Rate Statistics[16] for the period 1993 to 2001 is

[15] Austria, Belgium, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal, Spain and United Kingdom.

[16] Mortgage loan rates to households (N2), consumer loan rates to households (N3), ST lending rate to enterprises ((N4), medium and LT loans to enterprises (N5), time deposits (N8), savings accounts (N9).

used. Schuler and Heinemann extend Sander and Kleimeier's analysis (2003) by bringing in the medium and long-term lending rate and the two deposit rates. Also, instead of testing for integration between the national retail rate and the EU average rate like in Sander and Kleimeier, the study tests for cointegration between every pair of national rates. Furthermore in order to adjust for exchange rate related differentials, the authors use spreads between the national retail rate and the national money market rate. For instance for mortgage rates, the long-term government bond yield is subtracted and the cointegration equation used is

$$S_{it} = a+bS_{jt}+u_t \tag{5}$$

Where S_{it} and S_{jt} are the spreads between retail rate and money market rate for countries i and j at time t. u_t is an error term.

The results for the bivariate cointegration indicate varying patterns. In the market for mortgage loans to households, cointegration was found in 7[17] out of 21 possible combinations, No cointegration was found for Austria, Ireland, Italy and the UK. In the market for consumer loans, only 1 cointegration relationship was found (Germany and Austria). The market for short-term loans to enterprises shows more signs of integration with 11 (out of 36) cointegration relationships. Amongst, data for Ireland showed the highest number of cointegration equations. Several cointegration relationships are also detected in the market for medium to long term loans to enterprises (10 out of 21 combinations). However, it is the time deposits market that yields the highest number of cointegration combinations with 22 out of 45 possible relationships. In sharp contrast, only 3 cases of cointegration are detected for the savings deposit market. Overall, based on Schuler and Heinemann's (2002a) estimates, signs of integration are detected in the market for short-term, medium and long-term loans and in the time deposits markets. The markets for mortgage and consumer loans and for savings deposits are found to be fragmented.

It should be pointed out that the study by Schuler and Heinemann (2002a) use spreads to conduct their analysis and as noted by the authors themselves, the ECB statistics contain aggregated rates which may result in differences in the term structure between lending rates and market rates. Furthermore, the time period investigated correspond to major changes within the EU banking sector and as such would warrant the need to account for possible structural breaks in order to produce more robust results. The authors do acknowledge this fact but rule out the application of structural break tests due to limited data.

Schuler and Heinemann (2002b) subsequently consider a new approach to the integration process by investigating interest rate pass-through changes and suggest that the speed of the interest-rate adjustments is an indicator of financial retail integration. The reasoning being that greater competition in the EU market (triggered by the integration process) should be translated into faster pass-through of interest rate changes. Hence, the authors attempt to develop "benefit indicators" for financial retail market integration. The author concentrate on the period 1995-1999[18] whereby interest rates have been falling and this ties in with their investigation of the potential benefits of debtors. Due to the lack of data on deposit rates, the analysis is restricted to mortgage rates, consumer credit and short-term enterprise lending rates. Cointegration is tested

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[17] Portugal and Belgium; Belgium and Spain; Belgium and Germany; Spain and Germany; Belgium and Netherlands; Germany and Netherlands; Netherlands and Finland.

[18] The following 11 EU countries are examined: Belgium, Germany, Greece, Spain, France, Italy, Netherlands, Austria, Portugal, Finland and UK.

between 3 month money market rate and lending rates through the following error correction model:

$$\Delta L_t = c + \beta_0 \Delta M_t + \sum_{i=1}^{K} (\alpha_i \Delta L_{t-1} + \beta_i \Delta M_{t-i}) + \gamma(L_{t-1} - M_{t-1}) + \varepsilon_t \qquad (6)$$

L_t and M_t are lending and money market rates at time t. This equation, according to the authors, measures the adjustment speed. Effects on the retail rates are then simulated based on the estimations. The results show that Belgium is a fast adjuster for consumer credit and entreprise loans; Italy is the fastest reacting country with regards to enterprise loans; and that in Spain, Portugal and notably in Germany and Greece, pass-through is quite slow. Simulations are then carried out between the rates in the individual countries vis-à-vis a reference rate[19] to see if a country would benefit or not if rates converged. Overall, the results indicate that the retail credit market in Europe is still largely fragmented and the authors conclude that a more active cross-border retail transactions would speed up interest rate adjustment and benefit bank customers.

In their study, Baele et al (2004) investigate price-based indicators such as interest rate spreads and analyse their behaviour over time. While agreeing with the view that there are difficulties associated in applying the law of one price in retail banking market, Baele et al nonetheless argue that there are benefits in analysing price-based indicators over time. The study uses retail interest rates on short-term, medium and long-term loan to enterprises, consumer loans and mortgage loans to households, and time deposit. The data has been sourced from the ECB and spans over the period 1990 to January 2004. Based on the availability of data, up to 11 Western European countries are included in the samples. The study first analyses the cross-sectional dispersion of the interest rates

[19] For instance, Germany is chosen as a reference country for the mortgage credits and Belgium is chosen for the consumer credit market.

across the countries. The hypothesis being that dispersion should decrease as financial integration across markets increases. Baele et al (2004) conduct the analysis under three sub-periods, namely 1990-94, 1995-1998 and 1999 to January 2003. The dispersion results for the first sub-period show high volatility, especially around 1992-93. There is less dispersion in the second sub-period, with a substantial decrease after 1996. There are mixed results for the dispersion in the third period with decreases noted for medium and long term loans to enterprises while for short term loans and loans for consumer credit, the dispersion has not changed much and even increased between 2000 and 2003. Baele et al (2004) also look at the rates in 2003 and find that the dispersion results more or less tally with the historical analysis.

Baele et al (2004) also draw from the study by Adam et al (2002) and use their beta-convergence method to measure the speed of convergence in the banking market. This approach measures the speed at which convergence to a specific benchmark is happening. Along the same lines of reasoning as in Adam et al (2002), Baele et al (2004) choose the German bank interest rate as the benchmark. The following panel regression (using fixed effects) is estimated:

$$\because \Delta R_{i,t} = \alpha_i + \beta R_{i,t} + \sum_{l=1}^{L} \gamma_l \Delta R_{i,t-1} + \varepsilon_{i,t} \qquad (7)$$

Whereby R is the change in the spread of the relevant interest rate in one country relative to the corresponding German rate. Convergence is said to occur if a negative β coefficient is reported. The study estimates the beta convergence in two sub periods; pre 1999 and post 1999. The beta convergence results for the four lending rates and the time deposit rate mentioned show that convergence is detected in all cases. However, taking into consideration the pre and post-EMU periods, the speed of convergence seems to have increased only for interest rates for mortgage loans.

Baele et al (2004) also assess the development of banks' margins, (the difference between bank interest rates and comparable market rate), over time by looking at their cross-sectional standard deviation. They argue that convergence of these margins over time can be interpreted as a sign of greater integration while a decrease in the level of the margins would signal greater competition. In their analysis, the authors use the 10-year government bond yields as market rates for the medium to long term interest rates and the 3-month market rate for the short term interest rates. The study reports high dispersion rates in the margins for the lending rates to enterprises and consumer credit at the beginning of the nineties and stabilisation thereafter. The dispersion on margins on short-term loans is high for the whole period. As for the margins on mortgage rates, there is convergence post-1999. The authors are of the view that there is greater convergence for mortgage rates rather than for consumer credit because mortgage loans are generally collateralised; and, as such, closely follow the bond markets, which, on their part, have shown greater convergence.

The other window under which banking integration is measured by Baele et al (2004) is through the "news-based" approach. The argument is that if markets are integrated, then asset prices should only react to common news. Therefore, the interest rates for borrowers with the same risk should be influenced by factors common to all if the market is integrated. The assumption being that there are identical systematic risk characteristics. The study uses the movements of market interest rates of a specific country as proxy for common news. The following regression model which allows for time-varying and country-specific intercepts and slope coefficients is estimated:

$$\Delta R_{i,t} = \alpha_{i,t} + \beta_{i,t} \Delta R_{b,t} + \varepsilon_{i,t} \tag{8}$$

Where $R_{i,t}$ is the bank interest rate in one country while $R_{b,t}$ is the comparable market rate in the chosen benchmark country. $\alpha_{i,t}$ is the time-varying intercept, $\beta_{i,t}$ is the time dependent beta and $\varepsilon_{i,t}$ is the country specific shock.

The presence of integration requires 1) $\alpha_{i,t}$ to converge to zero, 2) the beta of the benchmark asset, $\beta_{i,t}$, to converge to one and 3) the proportion of the variance in $\Delta R_{i,t}$ explained by the common factor $\Delta R_{b,t}$ to increase towards one. The benchmark market rates chosen for the lending and deposit rates are based on correlation analyses between market rates at different maturities and the euro area interest rates. The 3-month money market rate is used as the benchmark for the short term loans to households and time deposits and the 2-year government bond yield is used for the medium and long term rates and for consumer credit. For the mortgage rates, the 5-year government bond yield is used as benchmark. As for the benchmark country, Germany and France are chosen. The results indicate that based on the variance proportion, integration is low for consumer credit and mortgages. There is however an increasing pattern for the rest of the rates. Overall, it can be noted that the results obtained by Baele et al (2004) based on their set of integration measures, i.e. cross-sectional dispersion analysis, the beta convergence approach and on the news-based approach yielded similar conclusions. With regards to the lending rates, the short-term rates seem to be more segmented than the medium and long term rates. For the household sector, consumer credit is still highly fragmented during the period under investigation while mortgage loans appear to be more uniform.

Kleimeier and Sander (2006) extend their previous analysis to include a difference-in-differences approach applied to the sigma and beta convergence measures which feature in Adam *et al* (2002)[20]. The authors look at the integration of retail lending rates in 10 Euro-zone countries against a benchmark of 8 non-Euro-zone countries including Japan, U.S. and the UK, over the period 1995-December 2002. The analysis is performed on both interest rate levels and interest rate margins for mortgage and corporate loans rates. Kleimeier and Sander (2006) also perform rolling cointegration analysis on both bilateral combinations of the series and on the series for each individual country against a weighted regional average. Their evidence is similar to that obtained by Adam et al (2002) who report convergence in corporate lending and for mortgages. The authors also report convergence in the non-euro-zone countries and conclude that the convergence in the interest rates may be a result of global rather than purely regional integration.

Another recent study that looks at the interest rate differentials in the euro area is the one by Affinito and Farabullini (2006) who set out to test the validity of the law of one price in retail banking. The study uses data from the ECB on 14 selected types of interest rates, of which there are 5 categories of deposit rates, 5 types of lending rates to households and 4 types of lending rates to non-financial corporations. The period investigated is from January 2003 to March 2005. In order to test for the law of one price in the euro area bank interest rates, the study uses two approaches, the first one tests for stationarity between the interest rate differentials and the second approach tests for equality between the estimated country coefficients.

[20] *Adam et al (2002)* use a convergence methodology (beta and sigma convergence measures) to test for integration in the average spreads for 3-months inter-bank rates, 10-year bond yields, mortgage rates and corporate loan rates before and after 1999.

In the first approach, the ADF (Augmented Dickey-Fuller) test and the KPSS (Kwiatkowski-Phillips-Schimdt-Shin) test are applied to the bilateral differentials between the interest rates of each pair of countries among the 12 euro area countries:

$$\delta_t^{i,j} = r_{i,t} - r_{j,t} \tag{9}$$

Where $\delta_t^{i,j}$ is the bilateral differential and $r_{i,t}, r_{j,t}$ the 14 types of interest rates. If the interest rate differential between any two countries is a zero-mean stationary process, then the two countries are said to have homogeneous interest rates. The results obtained by Affinito and Farabullini (2006) show widespread heterogeneity among the euro area retail bank interest rates except for interest rates on loans over €1million to non-financial corporation where 30% of bilateral differences are zero mean stationary processes. However, it should be pointed out here that inferences from unit root test based on only 27 observations are quite unreliable.

The second method used by Affinito and Farabullini (2006) looks at tests of equality of estimated country coefficients to detect whether there are any similarities between the countries. The following regression equation is estimated:

$$r_{i,t} = \alpha_1 m_{i,t}^1 + \ldots + \alpha_{27} m_{i,t}^p + \beta_1 d_{i,t}^1 + \beta_2 d_{i,t}^2 + \ldots + \beta_n d_{i,t}^n + \varepsilon_{i,t} \tag{10}$$

Where $r_{i,t}$ is the interest rate, $m_{i,t}^p$ is a time (monthly) dummy equal to 1 when p=t, and 0 otherwise, and $d_{i,t}^k$ is a country dummy equal to 1 when k=i, and 0 otherwise.

To test for the pair-wise similarities between countries, the following null hypothesis that each pair of coefficients, estimated from the above regression equations, is tested:

$$H_0: \beta_i = \beta_j \tag{11}$$

The results are not very dissimilar from the results obtained from the ADF and KPSS tests. However, the authors observe that the average interest rates tend to be more uniform across the euro area when the customers are larger and more sophisticated such as enterprises versus households and large versus small corporations. Overall, the authors conclude that the law of one price does not hold within the euro area bank interest rates.

Using the methodology proposed by Affinito and Farabullini (2006), Sorensen and Lichtenberger (2007) test for the determinants of the heterogeniety in the euro area market for mortgage loans for the period January 2003 to April 2006. The study considers 4 sets of mortgages with different maturity duration; namely up to 1 year, 1-5 years, 5-10 years and over 10 years. Consequently, Sorensen and Lichtenberger (2007) computes tests of coefficient equality for the pairs of estimated country dummy variables from a regression equation. A set of control variables which are considered to be instrumental in the determination of mortgage interest rates such as demand-side factors (GDP growth, property prices, credit risk), supply-side factors (funding methods, competition) and structural factors (country-specific institutional features). Based on their results, Sorensen and Lichtenberger (2007) find evidence that once the demand and supply factors are accounted for, the dispersion in mortgage interest rates is removed. The study also finds that institutional factors such as tax subsidies, loan to value ratios also seem to have an impact on mortgage rates.

Sorensen and Gutierrez (2006), on their part, apply a hierarchical cluster analysis technique to assess the degree of euro area banking integration during the period 1998 - 2004. The classical hierarchical cluster method over a fixed J time periods analyses an ordered paired list: $\{t_j, W_j; J=1,....j\}$whereby t_j represents different time periods and W_j are row matrices of the observed variables for each of the euro area countries in each time period. The variables selected for W_j take into account the demand and supply of credit and deposits (GDP growth, loans to households/non-financial corporations, index of house prices, etc.); structural factors (liquidity risk, pool of bank deposits, sixe of banks, etc.); and price indicators (bank margin, term structure, government bond yield).

Overall based on their results, Sorensen and Gutierrez (2006) find that the clustering has become more pronounced over the sample period. They suggest that this can be interpreted as an indication that euro area banking has become more homogenous with regards to economic and financial structures. They also uncover some distinct clusters, notably Germany, France and Belgium; Austria, Italy and Netherlands; Spain, Portugal and Greece. Sorensen and Gutierrez (2006) conclude that progress in banking integration is evident but given the substantial distances which persist in the clusters, there is still scope for further integration in the future.

Another study that specifically investigates European retail banking integration is the one by Vajanne (2007). Along the same lines as Murinde et al (2000) and Adam et al (2002), Vajanne uses the concepts of beta and sigma convergence to assess the degree and speed of convergence in interest rate spreads[21] for four categories of household credit (mortgage rates with 1 year and between 5-10 years; consumer loans with 1 year

[21] Vajanne (2007) use the lowest interest rates levels in each category as the benchmark in calculating the interest rate spreads. The reasoning being that the lowest interest rates are reflecting competition and integration.

and between 1-5 years) and in two categories of credit to non-financial corporations (loans up to EUR 1million and loans over EUR 1 million, both with 1 year maturity). The panel consists of the 12 euro area countries for the period 2003-2006. The results obtained by Vajanne (2007) show that the fastest rate of convergence is observed for large loans to non-financial corporations. As for housing loans, integration is present, especially for loans with short-term maturity. However, the degree of convergence is at a lower level than for the former category. As for the consumer credit rates, faster convergence is detected for rates with longer maturities.

2.5 Comments on existing studies

An overview of the literature, starting from the 1990s to the present, shows a mixed picture with regards to investigations on the process of European banking integration. A table summarising all the key studies and methodologies used is provided in Appendix 2A. The earlier studies on money and banking integration (Karfakis and Moschos (1990), Katsimbris and Miller (1993)) were done in the late 1980s and early 1990s, when capital controls were still in place in most European countries. Hence, not surprisingly, the results show little evidence of convergence. In the subsequent studies, (Alexakis et al (1997), Hall et al (1992), Holmes and Pentecost (1995)), the tests capture trends of convergence, mostly towards the German rate. The recent studies more specific to the retail banking sector, (Sander and Kleimeier (2000, 2001) Schuler and Heinemman (2002a)), extend their test area to different lending and deposit markets by typically conducting bivariate cointegration analysis on interest rate spreads. Other studies (Murinde et al, 2000, Adam et al, 2002 and Vajanne, 2007) draw from the growth literature to model convergence tests to assess the degree and speed of convergence. The remaining studies (Affinito and Farabullini, 2006, Sorensen and

Litchtenberger, 2007, Sorensen and Guiterrez, 2006), apply some different techniques such as the tests of coefficient equality and hierarchical cluster analysis to euro area retail banking sector.

Overall, for the 1990s period, the evidence in the literature so far paints a picture of a fragmented retail banking market. Regarding the more recent period, progress in the retail banking integration process is observed. This lends support to the opinion that the launch of the euro, as well as the initiatives stemming from the Single Market and more recently, the Financial Services Action Plan, have been effective. Nonetheless, in most of the recent studies, the persistence of cross-country heterogeneity is also clearly evident. Limited institutional convergence in European banking and the importance of national characteristics, among other factors, are considered to be responsible for these results.

In the case of several of these studies, a few major limitations have been identified. Firstly, only one of these studies (Sander and Kleimeier, 2000) tests for the presence of structural breaks. However, Sander and Kleimeier (2000) do not follow any rigorous methodology in factoring in the effects of the breaks. They simply split the data sample into two periods and eliminate the data from the years where the breaks are most frequent. So, on the whole, given that the sample period covered in most of these studies coincide with major developments in the European banking sector; it is highly probable that the data-sets tested have been subject to structural change. As discussed in the literature, if these breaks are not accounted for, it could lead to wrong inferences and conclusions being drawn. Secondly, in some of the studies reviewed (Schuler and Heinemann, 2002a; Sander and Kleimeier, 2003; Affinito and Farabullini, 2006), given the methodologies used, it is noted that the number of observations tested is rather limited and may bias the results. Thirdly, the sample periods covered in most of the studies stop in the early 2000s except for the one by Vajanne (2007) who considers a data sample up to 2006. The empirical model used by Sorensen and Litchtenberger (2007) also considers data up to the year 2006 but it must be noted that their analysis is predominantly an investigation of the determinants of mortgage rate dispersion rather than a direct assessment of the degree of integration within retail banking.

Appendix 2A
Table 2A.1 Summary of empirical studies

Wholesale financial/banking market				
Study	**Methodology**	**Data set**	**Period**	**Sample**
Karfakis and Moschos (1990)	Cointegration bivariate time-series (T/S) analysis	3&6 month yields on Treasury bills and 3-month loan rates	1979-1988	7 European countries
Katsibris and Miller (1993)	Cointegration bivariate T/S analysis	3&6 month yields on Treasury bills and 3-month loan rates	1979-1988	7 European countries + US
Alexakis et al (1997)	Bivariate and multivariate cointegration T/S analysis	3&6 month Treasury bills, bond yields and loan rates	1982-1993	5 EMS + 4 non-EMS countries
Hall et al (1992)	Cointegration and Kalman Filter analysis	Exchange rates, inflation rates & interest rates	1970-1990	12 EC countries
Holmes and Pentecost (1995)	Principal component analysis	3 month Treasury bills	1973-1992	6 EC countries
Holmes (2001)	Panel data unit root tests (CIP)	1&3 month Treasury bills, eurocurrency rates	1983-1998	6 EU + 3 non-EU countries
Neillis and De Sousa Figueira (2002)	Principal component analysis and time series cointegration test	Treasury bills, spot / forward exchange rates	1988-2001	Subsamples of countries from Europe, Asia & America
Adam et al (2002)	Panel data model based on convergence theory	3-month interbank rate, 10yr govt bond yield, mortgage rate and corporate loan rate	1995-2000	EU countries

Table 2A.1 Cont'd		**European retail banking market**		
Study	**Methodology**	**Data set**	**Period**	**Sample**
Centeno and Mello (1999)	Cointegration time series Error correction model	Lending rates and spreads	1985-1990	6 EU countries
Sander and Kleimeier (2000)	Cointegration time series Error correction model	Lending rates and spreads	1985-1997	6 EU countries + US, Japan
Sander and Kleimeier (2001)	Cointegration time series Error correction model	Mortgage loans to households, consumer loans and lending rates to enterprises	1995-2000	10 EU countries
Sander and Kleimeier (2006)	Difference-in-differences approach and cointegration	Margins on mortgages and ST corporate loan rates	1995-2002	10 Euro-zone countries +UK + 5 non-EU countries
Schuler and Heinemann (2002a)	Bivariate and multivariate cointegration T/S analysis	Mortgage to households,ST loans to enterprises, medium and LT loans to enterprises, time deposits and savings account [spreads are computed] frequency of data: monthly	1993-2000	11 EU countries
Schuler and Heinemann (2002b)	Cointegration analysis Error correction model [Interest pass-through changes are analysed]	Mortgage rates, consumer credit and ST loans to enterprises	1995-1999	11 EU countries
Murinde et al (2000)	Fixed effects panel data model derived from convergence theory	Bank output measures in terms of 1) loans 2) deposits	1993-1997	10 transition economies plus EU countries

Table 2A.1 Cont'd		European retail banking market		
Study	**Methodology**	**Data set**	**Period**	**Sample**
Baele et al (2004)	Cross-section dispersion analysis, beta convergence model based on Adam et al (2002) and news-based approach	Short-term loans to enterprises, medium to long term loans to enterprises, consumer credit, mortgage rates and time deposits	Jan 1990-Dec 2003	Up to 11 Euro-area countries depending on availability of data
Affinito and Farabullini (2006)	Unit root tests on bilateral differences Tests of equality between estimated country coefficients	Different types of deposit rates and lending rates to households and to the non-financial sector	January 2003 – March 2005	Euro area countries
Sorensen and Guiteirrez (2006)	Hierarchical cluster analysis	Price indicators (bank margins, govt bond yield); structural indicators (credit risk, size of banks, Herfindahl index, etc.); cyclical indicators (GDP growth, loans, index of house prices, etc)	1998-2004	Euro area countries
Sorensen and Lichtenberger (2007)	Tests of equality between estimated country coefficients	Mortgage loans with 1 year, 1-5 years, 5-10 years and >10 years	January 2003-April 2006	Euro area countries
Vajanne (2007)	Beta and sigma convergence tests	Mortgage rates (1 year, 5-10 years), Loans to non-financial corporations (up to and over Eur 1 million)	2003-2006	Euro area countries

Chapter 3

Banking regulation in the European Union

3.1 Introduction

As argued in the literature, since the 1980s, with the launch of the Single Market Programme, the European banking sector has evolved from a highly regulated, restrictive and often anti-competitive market to a more competitive and open markets. According to Evans et al (2008), these regulatory changes can be grouped under three main classifications. The first stage is deregulation at national level which included measures such as the elimination of interest rate controls and reduction in reserve and investment requirements. The second stage was aimed at strengthening competition at bank level through the elimination of capital controls and restrictions on entry as well as the introduction of the first and second banking Directives. The third stage is termed as prudential regulation and is exemplified by the rules on deposit insurance and minimum capital requirements. What are notable here are that in the 1970s and 1980s, the objectives of the European Commission were mainly aimed at banking deregulation but have since shifted focus to prudential regulation.

The aim of this thesis is to empirically analyse the convergence process in the European retail banking sector since the 1990s and until December 2008. Such an analysis should be viewed alongside the triggers of the whole process of banking integration, i.e. the major regulations which aim at removing regulatory barriers at national level and establishing a single European banking market. Indeed, the elimination of technical, structural and legal barriers has been actively pursued by the European Commission through a process of deregulation and re-regulation in order to create a harmonised and homogeneous banking market. Consequently, the aims of this chapter are two-fold. Firstly the objective is to critically analyse the regulatory changes in the European Union banking industry over the past two decades. A special focus is given to the implementation of certain key legislations such as those on the deposit guarantee schemes and on capital requirements. Secondly, this chapter lays down the foundations for further analysis in subsequent chapters whereby an empirical analysis is conducted on the European retail banking sector. In particular, the association between the various regulatory changes and the convergence results obtained in chapters 5, 6 and 7 are closely monitored in terms of the timing, impact and implications for the retail banking sector.

This chapter is organised as follows. Section 3.2 critically reviews the key banking regulations stemming from the Single Market initiatives while section 3.3 conducts a comparative analysis of the transposition of key EU Directives into national law, with special focus on the capital adequacy directive and the deposit guarantee scheme. The aim here is to investigate whether the end results have led to greater homogeneity across the Member countries. Section 3.4 concludes.

3.2 EU banking directives

The foundations for the establishment of a single market in banking are embedded in several European Directives which aim at creating an integrated banking market through the gradual elimination of regulatory barriers and the setting up of a homogenous platform for banking. Prior to the Single European Act, two major directives were implemented; the First Banking Directive of 1977 and the 1983 Directive on the Supervision of Credit Institutions on a Consolidated Basis.

The ***First Banking Directive of 1977*** created the right of entry and establishment for foreign banks along the same rules which existed for domestic banks. In essence, foreign banks had to meet the host country's national requirements and obtain authorisation in each relevant Member States. However, obstacles still prevailed as the host country's requirements (minimum capital and solvency ratios) differed from state to state. Another impediment was in the form of the "own funds" requirement which meant that branches were treated like separate entities and thus had to tie up substantial amounts in each state. This greatly hampered the process of providing cross-border services. Subsequently, the Commission introduced a two-stage process whereby most exchange controls were to be removed by 1992 (Dixon, 1991). The ***Supervision of Credit Institutions Directive of 1983***, attempted to fill in some of the gaps in the First Banking Directive by introducing the common principle that supervision of banks' activities was to be conducted on the basis of their worldwide activities. In this way, capital requirements were to be based on global income so as to address concerns regarding solvency of banks (Howells and Bain, 2008).

Since the Single European Act, there have been a number of directives in the banking industry, most notably the Second Banking Directive. The main ancillary directives to the Second Banking Directive are the Own Funds Directive; the Solvency Ratio Directive; the Large exposures Directive; the Capital Adequacy Directive; and the Deposit Guarantee Directive; amongst others (see Tables 3A.1 and 3A.2 in Appendix 3A for a complete list). These directives are often cited as being the key triggers to a more liberalised and integrated European banking market (Gardener et al, 2000).

In 1989, the ***Second Banking Coordination Directive***, which, at the time, was considered as one of the most important piece of Community legislation for the removal of barriers to banking in the EU, was adopted. This Directive came into force on 1 January 1993 and one of the key provisions of the directive is the "single banking licence" which automatically permits authorised credit institutions of a Member State to set up branches, or supply cross-border services in all other Member States. A comprehensive list of services was considered valid under the single licence and is listed in Table 3B.1 in Appendix 3B. The range of banking activities allowed banks to fully participate in securities business directly or via subsidiaries and in essence, laid down the principle of universal banking. However, as stated by Howells and Bain (2008), difficulties remain, especially with regards to the interpretation of the listed banking activities and on the regulation of banks engaged in both banking and securities business.

The ***Own Funds Directive*** (89/299/EEC) is a complementary measure to the Second Banking Directive and aims at harmonising the terminology around banks' "own funds". With no previous clear description of banks' own funds (except for a vague definition in the First Banking Directive), the Commission sought to come up with a clear-cut and uniform definition of a bank's own funds (Dixon, 1991). The own funds of a credit institutions can serve as an important yardstick for the authorities, especially in the assessment of the solvency ratio. The directive distinguishes between original own funds (Tier 1 capital) and additional capital (Tier 2 capital) which altogether consist of paid-up capital and share premium account, reserves and profit and losses brought forward, revaluation reserves, funds for general banking risks, fixed-term cumulative preference shares, value adjustments and other items (as listed in article 3 of the Directive). The Own Funds Directive is viewed as a major directive that has increased the soundness of credit institutions in Europe, with the ultimate benefit for consumer confidence and security. Moreover, this directive was fundamental for the interpretation of numerous other directives such as the Second Banking Directive, the Solvency Ratio Directive and the Capital Adequacy Directive (Dixon, 1991, European Commission, 1999b, & 2000a)

Another accompanying directive of the Second Banking Directive is the ***Solvency Ratio Directive*** which was adopted on 18 December 1989 and subsequently amended between 1994 and 2000. The Community legislation stresses the relevance of the establishment of an adequate solvency ratio for supervision of credit institutions. As defined in the Council Directive 89/647/EEC (European Commission, 1999c), "a ratio which weights assets and off-balance-sheet items according to the degree of credit risk is a particularly useful measure of solvency". The directive aims at strengthening a common banking system by eliminating distortions which may arise from competitive practices (European Commission, 1999b). The solvency ratio expresses own funds as a proportion of risk-adjusted assets and off-balance sheet items. The denominator is obtained by multiplying each class of asset and off-balance sheet item by their corresponding risk weighting element. The directive groups borrowers into broad categories (for example credit institutions, central governments) for the purpose of assigning risk weights. The provisions contained in both the Own Funds Directive and the Solvency Ratio Directive were made in line with the provisions of the Basel agreement on capital adequacy (Dixon, 1991).

As for the ***1992 Large exposures Directive,*** this directive has been in operation since 1994 and tightened the capital adequacy requirements in all other directives by requiring banks not to commit more than 25% on a single investment and to report all large exposures (> 15% of own funds) to individual borrowers. Another requirement of this directive was that total amount of resources allocated to a single investment should not exceed 800% of own funds (Goddard et al, 2007, Howells and Bain, 2008). Another relevant directive for the banking sector is the 1993 ***Investment Services Directive*** which created a "European passport" as from January 1996 for non-banks investment firms to carry out investment services in all Member states. This directive also set out the provision for banks and investment firms in other Member states to be allowed remote electronic access to other Members' non-physical trading floors. The impetus is to boost competition between different EU markets (European Commission, 1996). In 2000, the Large Exposures Directive together with all previous banking legislations (the First and Second Banking Directives, the Own Funds and the Solvency Ratio Directives) were consolidated into the ***Consolidated Banking Directive*** for the sake of clarity and rationality.

Another key directive especially for the retail banking market is the 1986 ***Consumer credit Directive*** (CCD) which was adopted in 1987 and subsequently revised in 1990 and 1999. The main objective of this directive was to create a common market for credit in the European Union. However, this directive was based on the principle of minimum harmonisation which resulted in Member States establishing different national legislation which in turn, became obstacles to the provision of pan-European products (European Commission, 2005a). For example, as reported by Lannoo and Munoz (2004), in Belgium, according to the Consumer Credit Act, consumers have to sign any credit agreement and include a handwritten note below their signature. In France, similarly, according to the French code de la Consommation, a handwritten declaration has to be provided, otherwise the credit agreement and guarantee is rendered void. In Germany, according to the German Civil Code, in the event of delays in repayments, lenders must give borrowers a two-week suspension period before cancelling the contract. Thus, as argued by Lannoo and Munoz (2004), the minimum harmonisation approach coupled with the fact that the CCD does not allow for mutual recognition of other non-harmonised areas, have not facilitated the provision of cross-border consumer credit. Existing and potential providers have had to be familiar with the domestic laws of each Member State in which they have operations.

Having recognised the need to revamp the CCD to remove the obstacles to an integrated consumer credit market, a revised Consumer Credit Directive was put forward in 2002 by the European Commission. But it took another six more years of negotiations before the new CCD was finally adopted. The practical implications of full harmonisation which had been included in the 2002 proposal presented a major challenge; especially with regards to the calculation of the annual percentage charge. Finally in April 2008, the new CCD was adopted and the deadline for the transposition into national law was set for 12 June 2010. Unlike the previous CCD, the new directive is based on maximum harmonisation principles for 1) pre-contractual and contractual information; 2) for the calculation method of the annual percentage rate of charge (cost of credit); 3) for early repayment conditions; and 5) for the right of withdrawal. The full harmonisation approach means that once every Member State transposes the directive into domestic law, they cannot provide greater rights or more stringent rules than the CCD. The aim behind full harmonisation is to facilitate the cross-border provision of credit instruments and to instil confidence for consumers who would face the same level of protection throughout the EU (European Commission, 2007b, 2008).

Based on information available on Eur-Lex (2010) it can be observed that the new CCD has already been transposed into domestic law by most of the EU member states. For some countries, this information is not yet available but it does not necessarily mean that the transposition into domestic law has not taken place. Generally, the new Consumer Credit Directive has necessitated changes to several domestic consumer credit legislations. For instance, in the UK, an extensive list of amendments to existing consumer credit legislation was laid before Parliament on 30th March 2010 (BIS, 2010). These amendments, which affect various existing secondary legislations, have been drafted into five 2010[1] Consumer Credit Regulations and will come into force on 1st February 2011 (OPSI, 2010). Along similar lines, in Netherlands, on 18th March 2010, the Bill implemented the new CCD was presented to the Dutch Parliament and transposed into Dutch law on 11 June 2010 in the Dutch Financial Supervision Act and the Dutch Civil Code, amongst others (Schlingmann, 2010). In Germany, the changes to the laws to implement the Credit Directive were published in the country's *Gesetz* official journal in August 2009 and the legislation entered into force on 11 June 2010 while in Ireland, the statutory instrument was published in the official journal, *Iris Oifigiúl,* on 11 June 2010 and entered into force on the same day (Eur-Lex, 2010). Hence, 20 years after the adoption of the first Consumer Credit Directive, the new revised directive which seeks to eliminate the barriers identified in the consumer credit market and improve the functioning of the internal market in banking has been agreed upon.

The ***Takeover bid Directive*** is another relevant directive for the European banking sector. The intention of this directive is to provide a major boost to competition in the European Union by establishing minimum guidelines on takeover bids for the securities of companies which are traded in one or more Member States. These guidelines address

[1] UK Statutory instruments 2010 No. 1010 -1014 on Consumer Credit (EU Directive / Total charge for credit/ Advertisements / Disclosure of Information / Agreements) regulations 2010

the laws, regulations, codes of practice and other measures regarding the supervising of the bid and the protection of holders of securities. The Commission initially proposed the setting up of Europe-wide takeover regulation in 1989 but due to differences in corporate governance arrangements in the Member States, negotiations and amendments have spanned over 15 years and it is only in 2004, that the Directive was finally adopted. However, although the main purpose of the directive is to ensure a level playing field in the EU by setting up an efficient takeover mechanism, the key provisions of the directive still allow for considerable deviations at national level. In 2007, the Commission conducted a review of the implementation of the Takeover bid Directive and reported that several Member States have been reluctant in removing takeover barriers and that the use of exemption rules from the provisions of the Directive by many may well lead to new obstacles in the corporate market (European Commission (2007d).

Another crucial retail banking directive is the ***Deposit Guarantee Schemes Directive*** of 16 May 1994 which aims to provide protection to all EU depositors and consolidate the workings of the EU internal market by establishing a harmonised minimum deposit guarantee level of Eur 20,000. The Directive requires every credit institution to join a deposit guarantee scheme. Moreover, money deposited in branches set up in other Member States is also protected by the home country deposit guarantee scheme (European Commission, 2000b, 2008a). However, under article 4(1) of the Directive, a temporary derogation, subject to extension, prevailed until 31 December 1999. Known as the "export prohibition clause", this provision stated that cover offered by credit institutions of a home Member State in a host Member State should not exceed the maximum level of cover in that country. The reason behind such a clause was to prevent the directive from turning into an instrument of competition. After a careful examination of the pros and cons, the Commission decided not to prolong the export prohibition clause. The initial argument justifying the clause could not be quantified and more significant was the argument that the clause acted against the establishment of a genuine single market in banking (European Commission, 1999d).

The 1994 Directive was amended in March 2009 as it was felt that the current guarantee level of Eur 20,000 needed to be revised to promote further financial stability and to maintain depositors' confidence in the market. The revisions to the existing directive were prompted by the recent financial crisis which highlighted the need to increase the minimum level of deposit protection, create a more transparent playing field and to manage future crises. As a starting point, the directive adopted in March 2009, increased the minimum coverage to Eur 50,000. This amount further increases to Eur 100,000 by December 2010. Due to the urgency created by the financial crisis, the fixed cover level of Eur 100,000 was adopted without being substantiated by an impact assessment exercise. However, the European Commission retrospectively undertook an impact assessment on the Eur 100,000 figure and the study underpins the new limit as it is estimated that the basis of this increased coverage, 95% of eligible accounts will be fully covered. This represents an increase of 7% compared to pre-crisis figures of 89% coverage (European Commission, 2010).

Following the legislative changes of March 2009, on 12 July 2010, the Commission adopted a legislative proposal for a complete revision of the Directive on Deposit Guarantee Schemes. The proposals are as follows. Firstly, in the case of a bank failure, it is proposed to effect reimbursements to account holders within 7 days, which would be a substantial improvement on the current practice whereby depositors may have to wait for months before getting their payouts. The faster payouts will come into effect in

December 2013. Secondly, the Commission proposes to facilitate reimbursements and decrease the level of bureaucracy in cases where deposits are held in a failing bank located in another Member state while the account holder lives in another one. The proposal is that the guarantee scheme of the country of residence of the account holder should effect the payout and get reimbursed later by the scheme where the bank's headquarters are located. The current practice is to get the payout from the bank's headquarters and it is a lengthier process. The new simplified system will come into effect in 2012. The third proposal is to provide more information to depositors on their coverage and its functioning while the fourth proposal is about securing the funding of the guarantee schemes through a combination of reserves, contributions and borrowing. The financing requirements will have to be achieved by Member States by 2020 (European Commission, 2010a).

Another directive which is central to the proper functioning of a European banking market is the 1993 ***Directive on capital adequacy of investment firms and credit institutions*** which sets out measures to cover against market risks, position risks, foreign exchange risks and other risks. The EU capital framework of 1993 is based on the 1988 Basel Accord and its amendments. This directive has been amended on two occasions in 1998 but very soon an international consensus emerged that capital charges for credit risk need to be reviewed. It has been observed that the current system fails to capture the risks being taken by banks and investment institutions. Hence alongside the Basel Accord, the Capital Adequacy Directive was also under review for several years after. Finally, after more than 5 years of consultation, a new capital requirement framework for banks and investment firms was formally adopted by the European Council and Parliament in June 2006 and came into force in January 2007. The amended Capital Requirements Directive (CRD) is one of the measures of the EU

Financial Services Action Plan[2] (FSAP). This Directive updates the supervisory framework in the EU and also reflects the Basel II[3] rules on capital standards agreed at G-10 level.

The Capital Requirements Directive also comprises the Directive on the taking up and pursuit of the business of credit institutions (2006/48/EC) and the Directive on the capital adequacy of investment firms and credit institutions (2006/49/EC). The new directive aims to consolidate the harmonisation and mutual recognition of credit institutions setting up business in member states. Moreover, the directive clearly establishes that prudential supervision for financial soundness and solvency rests solely on the home Member state whereas supervision of market risk should be shared between the home and host member states. The Directive on the capital adequacy of investment firms and credit institutions stipulates the capital adequacy requirements for these financial institutions, the rules for their calculation and the rules for their prudential supervision. This is done by laying down minimum capital requirements which weigh assets and off-balance sheet items according to the degree of risk (European Commission, 2006a).

Faced with the banking crisis, in October 2008, the European Commission presented a review of the current rules and proposed the requirement for banks to hold a higher amount of capital in the risk of failure and the introduction of a new co-ordinated cross-border supervisory process of EU banks. The new rules will impose the requirement on banks to retain 5% of the securitised products they originate and sell. The reforms also

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[2] The FSAP, adopted in 1999, brings together the legislative and non-legislative policies aimed at creating an integrated financial market in Europe. It sets a schedule for the adoption of a series of 42 directives and measures by the year 2005.

[3] Basel II is a revision of the existing 1988 Basel Accord and aims to make the regulatory framework more risk sensitive by taking into account banks' current risk management practices.

puts a ceiling of no more than 25% of its own funds on how much a bank can lend a client in order to limit banks' exposure to any one party. This threshold can be exceeded only for exposures between credit institutions and for not more than Euro 150 million. Another major reform consists of the setting up of colleges of supervisors consisting of national regulators who would meet regularly to share information and monitor big cross-border banks. These proposals were agreed by the European Parliament in May 2009 and would come into effect in October 2010 (EurActiv online, 2009). The Commission has also stated that the international crisis has shown the need to further review the reforms for the regulatory and supervisory model within the EU and has requested the Commission to report back with appropriate legislation by the end of December 2009. Since, the Commission has launched a set of reviews.

The first one was in April 2009, whereby the Commission proposed changes which would consider risks related to trade books, securitisation and managers' remunerations. The proposed new rules aim to tighten up the way banks assess the risks associated with their trading books; introduce higher capital requirements for re-securitisations; and to encourage remuneration policies and practices within banks that do not reward excessive risk-taking. Then, in July 2009, the Commission launched a consultation process to consider more possible changes to the Capital Requirements Directive which would affect the capital requirements for residential mortgages in foreign currencies and the removal of national discretions. More recently, in February 2010, the Commission opened public consultations on further changes to the CRD relating to liquidity standards, definition of capital, leverage ratio and counterparty credit risk, amongst others. A public hearing was further held in April 2010 on these potential changes (European Commission, 2010b). It can thus be observed that the financial crisis has prompted a string of changes and reviews of some major directives and this exercise is set to continue in the foreseeable future.

A more recent directive, which is also considered fundamental for the functioning of a single market in banking, is the ***Payments Services Directive*** (PSD) which was adopted in 2007. This directive sets out the legal provisions for the Single Euro Payments Area (SEPA) initiative which aims at creating an integrated market for electronic payments services whereby the distinction between cross-border and domestic payments will be removed. To do so, major technical, legal and commercial barriers have to be dismantled at country-level so that payments such as credit transfers, direct debit and card payments can be effected securely and efficiently. The European Payments Council has already made significant progress towards the implementation of SEPA which focuses on low value euro payments[4] which are generally processed in different ways across the EU (European Commission, 2007). The SEPA project was officially started in 2002 and was gradually implemented in 2006 - 2008. In 2009, the SEPA direct debits phase was launched and expected to be fully operational by 2010. In 2011, only SEPA-compliant cards will be issued so that SEPA will be able to process all card payments (ECB, 2009).

Member states had until 1st November 2009 to transpose the Payments Directive into national law. In July 2010, the European Commission (2010c) published a working document detailing the transposition process of the Payments Directive in each individual Member State. Based on the information gathered by the Commission, it can be observed that the majority of the 27 EU Member States complied with the

[4] High value euro payments are conducted via the large value central bank payment system TARGET which was launched in 1999 and succeeded by TARGET2 in 2007.

transposition deadline. Looking specifically at the 15 EU countries, most of the countries, namely; Austria, Denmark, France, Ireland, Luxembourg, Germany, Netherlands, Portugal and the UK have written the Payments Services Directive into national laws which entered into force in November 2009. As for Belgium, Spain, some provisions of the PSD were adopted in 2009 and the rest in 2010, mostly in April-July. The PSD entered into force in March, April, July and August 2010 for Italy, Finland, Greece and Sweden respectively (European Commission, 2010c).

3.3 Comparative study on implementation of banking directives

As shown in the discussion in the above section 3.2, the process of regulatory harmonisation within the EU banking sector has spanned over three decades since the introduction of the First Banking Directive in 1977. Subsequently several major directives have been introduced and these have often been subject to numerous revisions and amendments over the years. As stated by (Howells and Bain, 2008), two main concerns have emerged from the European regulatory process. Firstly, Member States have been slow in implementing the existing directives. Indeed, the European Commission's scoreboard which monitors the implementation of the internal market directives, reports that at the end of 2005, the transposition deficit[5] was 1.9% for the EU-15 countries and 1.6% for the EU-25 group. However, this is a considerable decrease from the 6.3% average deficit in 1997. With regards to the transposition of the Financial Services Action Plan (FSAP) directives, the transposition deficit at the end of 2005 was relatively high (around 25%) for most of the EU-15 countries[6] (European

[5] Percentage of Internal Market directives not yet written into national law.

[6] Austria (0%), Denmark (0%), Germany (5%), Ireland (5%), Finland (5%), Italy (15%), Belgium (20%), Spain (25%), France (25%), Netherlands (25%), Sweden (25%), Luxembourg (35%), Portugal (40%).

Commission, 2006b). In the latest scoreboard published, the European Commission reports that on average, the transposition deficit has reduced considerably over the recent years and stood at 0.7% in 2009, which is well below the 1% target. However, the Commission also stresses the need to reduce the transposition delays. On average, the Commission estimates that it takes a Member States another 9 months after the transposition deadline before implementing the EU directives (European Commission, 2009a).

The second concern that has emerged is that inconsistencies in the implementation of the internal market directives are common. This is evidenced by the number of infringement cases brought against the Member States over the years. For instance, at the end of 2005 the number of open cases of infringements mostly due to misapplication ranged from 31 for Denmark to 157 for Italy, creating an average of 71 for each EU-15 country (European Commission, 2006b). In 2009, the total number of internal market infringements cases against the EU-15 countries stood at 929 (European Commission, 2009). Specific to the financial services industry, as at November 2009, the total number of directives stood at 105 and the back-log of non-transposed directives was 34 for the EU-15 countries, with Greece (5) , Spain (5) and Belgium (5) holding the highest number of non-transposed financial services directives compared to the UK (0) and Germany (0) (European Commission, 2009).

Consequently, it can be argued that the delays in transposing directives into national laws and the diversity in which they have been implemented, over the years, have created barriers to the effective functioning of an integrated internal market. In order to verify this statement with regards to the banking market, the implementation process for two major directives, namely the Deposit Guarantee Directive and the Capital Requirements Directive are analysed below.

3.3.1 Implementation of the Deposit Guarantee Directive

As discussed in section 3.2, the 1994 Deposit Guarantee Directive was based on the principle of minimum harmonisation. This means that Member States had the freedom to decide on the level, scope, coverage as well as the products covered, the payout delays and the funding of the schemes (European Commission, 2010d). In fact, in between 1994 to 1999, a transitional period, whereby a minimum guarantee of between Eur 15,000 and Eur 20,000 could be maintained, was granted to Member States. Since, the minimum level of Eur 20,000 has prevailed (European Commission 2006c). A look at the level of minimum guarantee cover of current deposit guarantee schemes in the individual EU countries (see Table 3.1 below) highlights the diversity that exists among the schemes in the EU-15[7] group of countries since 1993 till 2010.

Furthermore, the scope of the deposit coverage also varies between the EU countries. For instance, in Belgium, Luxembourg, France, Netherlands, Sweden and UK, branches and subsidiaries of foreign banks are expected to participate in the deposit protection scheme, except for branches of banks from other EU countries, which are covered by their home state schemes. In Italy, on the other hand, participation in an Italian scheme is required for both EU and non-EU banks (BIS, 1998). As argued by Dermine (2005), the "home country" approach has two main drawbacks. The first is that in the event of

[7] In line with the overall focus of this thesis, the analysis in this section also focuses on the EU-15 group of countries.

the collapse of large international banks from small European countries, the cost of the bail-out for the smaller countries may be difficult to bear. Secondly, the cross-border spill-over effects in the event a bank is closed out will be significant, as other countries will be affected and conflicts of interest are bound to arise if an effective network of cooperation is not in place. Another stark difference is with regards to currency coverage. For example, in Germany, Italy, Luxembourg, Netherlands, Sweden, all deposits are covered irrespective of currency. However, the Belgian, French, British schemes exclude foreign currencies, except for the European Economic Area currencies. In addition, as highlighted by the BIS report (1998), the deposit schemes also differ with respect to the administration, mode of operation and funding of resources.

Given the clear diversity in every aspect of the deposit schemes of the EU countries, it cannot therefore be disputed that these may well have erected barriers to the proper functioning of a single market in European banking instead of creating the homogeneous platform the Directive intended. Furthermore, it is not surprising that the European Commission (2010d) argues that this diversity has led to more instability and uncertainly during the financial crisis as the confidence of savers was severely dented. The revisions to the Deposit Guarantee Scheme Directive aim at addressing all the gaps identified so far in the previous directive and should deliver the expected benefits in future. However, the challenge of meeting the needs of an ever-evolving financial market will remain.

Table 3.1 Guarantee levels for EU-15 countries from 1993-2010 (Eur)

EU-15	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
AT	-	14535	18895	18895	1,895	18895	20000	20000	20000	20000	20000	20000	20000	20000	20000	100%[8]	100%	100000
BE	-	-	15000	15000	15000	15000	15000	20000	20000	20000	20000	20000	20000	20000	20000	100000	100000	100000
DK	33099	33412	41122	40287	39851	40275	40305	40198	40342	40383	40296	40329	40201	40201	40201	100%	100%	100%[9]
FI	-	-	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	50000[10]	50000	50000
FR	-	-	60980	60980	60980	60980	70000	70000	70000	70000	70000	70000	70000	70000	70000	70000	70000	70000
DE	-	-	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	100%[11]	100%	100%[12]
GR	-	-	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	100000[13]	100000	100000
IE	13200	13200	15000	15000	15000	15000	15000	20000	20000	20000	20000	20000	20000	20000	20000	100%[14]	100%	100%[15]

[8] Deposits for individuals were guaranteed for an unlimited amount effective retroactively from 1 October 2008. This unlimited protection of deposits remained in effect until 31 December 2009.

[9] Valid until 30th September 2010

[10] Increased from Eur 25000 on October 2008

[11] Adopted in October 2008

[12] Extended until December 2010

[13] As from October 2008

[14] Introduced in September 2008

[15] Until September 2010

Table 3.1 Cont'd Guarantee levels for EU-15 countries from 1993-2010 (Eur)

EU-15	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
IT	413166	413166	413166	413166	103291	103291	103291	103291	103291	103291	103291	103291	103291	103291	103291	103291	103291	103291
LUX	12395	12395	12395	12395	15000	15000	15000	20000	20000	20000	20000	20000	20000	20000	20000	100000[16]	100000	100000
NL	17400	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	40000	40000	100000[17]	100000	100000
PT	-	33750	33750	33750	33750	33750	25000	25000	25000	25000	25000	25000	25000	25000	25000	100000[18]	100000	100000
ES	9015	9015	14093	14093	14093	14093	15000	20000	20000	20000	20000	20000	20000	20000	20000	100000[19]	100000	100000
SE	-	-	28745	28975	28629	26349	19197	28308	26878	27314	27533	27714	27595	26766	27719	50000[20]	50000	50000
UK	26478	25411	23606	27127	29996	28350	32170	32046	52095	48732	44977	44961	49498	50800	51991	62890[21]	56152	57785

Source: European Commission (2006c) and author's updates

[16] Since October 2008
[17] Since October 2008
[18] Since November 2008
[19] Since October 2008
[20] Since October 2008
[21] Since October 2008, the UK deposit guarantee has been raised from £35,000 to £50,000

3.3.2 Implementation of the Capital Adequacy Directive

With regards to the Capital Adequacy Directive, a study, contracted by the European Commission (2009b), conducts an extensive investigation of the implementation of the CAD by all the EU countries. Given that the focus of this thesis is on the EU-15 group of countries, the discussion in this section will be limited to the implementation of the CAD by the 15 EU countries. The main findings of the report are as follows. Firstly, the study finds that the Directive was transposed into national laws by the deadline, i.e. the start of 2007 for all the 15 countries. Secondly, the study also finds several areas of discrepancies between the provisions of the CAD and the national laws. Thirdly, the study uncovers some areas where "goldplating" (a term which refers to the practice of exceeding the provision of a directive when transposing it into national law) has taken place.

With regards to the application of the CAD in each individual country, the study finds that in 7 out of the 15 countries, namely; Austria, Belgium, Denmark, Germany, France[22], Italy and Portugal; the implementation of the CAD into national laws mainly complies with its provisions but however it has also identified that several provisions have not been not transposed or only partially implemented. Some of the reasons identified for the non-implementation of certain directive provisions relate to the fact that certain concepts in the CAD do not exist under local laws or because local legislators prefer to wait for further developments at the EU level. In 3 of the countries mentioned above, namely; Belgium, Germany and Portugal; the study also identifies that goldplating, which is deemed to be counter-productive to the correct application of the CAD, has taken place. However, the report does highlight the fact that sometimes

[22] For the non transposed provisions, the study reports that the French authorities are working on these provisions.

goldplating may inadvertently occur due to the incorrect translation of the English version of the Directives and due to the complexity involved in transposing all the provisions. As for the remaining 8 countries, Finland, Greece, Ireland[23], Luxembourg, Netherlands, Spain, Sweden[24] and the UK[25], the assessment is that the implementation of the CAD into national laws has been successful (European Commission, 2009b).

Based on the information above, it can be concluded that in spite of the complexity of the Capital Requirements Directive, the bulk of its provisions have been transposed adequately into national laws. The implications for EU banking convergence are significant as a single, uniform and harmonised platform for the provision of banking products and services should boost competition, efficiency and therefore integration. Furthermore, the more recent amendments to the CRD seek to address any gaps in the banking market which have been highlighted by the recent crisis. In particular, article 129 of the 2006 CRD, which has been revamped as article 131a in the revised 2009 CRD, is noted. This article requires all cross-border banking groups to have a college of supervisors in place by the end of 2010. Indeed, the argument is that a more coherent cooperation and coordination between authorities is critical for ongoing supervision and in times of crisis. The guidelines for the establishment of these supervisory colleges is currently being discussed and the transposition deadline is the end of 2010 (CEBS, 2010). Ultimately, convergence at the regulatory and supervisory levels, if well-designed and efficient, should lead to greater convergence in the EU banking market.

[23] Minor short-comings have been identified for Ireland but the authorities are working on them.

[24] Some provisions have not been or only partially implemented but the overall effect of these is deemed to be insignificant.

[25] Very few non-transposed provisions have been identified but generally the overall implementation is considered to be very good.

3.4 Conclusions

The discussion in this chapter highlights how the legislative process to remove regulatory barriers and establish common sets of rules in the European Union has been profound and ongoing throughout the last two decades. The first stage of this legislative process focused on deregulation at national level through the elimination of interest rate controls and relaxation of limitations on domestic branching, amongst other measures. The second stage in the legislative process saw the enactment of the First and Second Banking Directives which aimed at opening up the banking market by eliminating barriers on entry of foreign banks and the elimination of capital controls. The third stage in the legislative process sought to strengthen prudential regulation by establishing safety nets such as the deposit schemes and capital requirements. Overall, the aim behind this extensive exercise of deregulation and prudential re-regulation is expected to increase competition and create a more homogeneous European banking market.

Hence, the aim of this chapter is to review and conduct a thorough analysis of the main regulatory changes over the years. The main findings are that several directives such as the First and Second Banking Directive did not deliver all the benefits envisaged at their inception due to varying host country requirements and complexity and interpretation of the provisions in the directives. Furthermore, it is also observed that delays in transposing directives as well as partial transposition of certain provisions into national laws have been common occurrences. In particular, this chapter has looked at the implementation paths of 2 major directives, namely on the deposit guarantee schemes and capital requirements and finds that the minimum guarantee level and flexibility provided in the initial Deposit Guarantee Directive may have acted more like a barrier to the establishment of a common banking market. As for the Directive on Capital

Requirements, the complexity and interpretation of its provisions have led to inconsistencies in the application of this directive into national law. In addition, both directives are currently undergoing further amendments and reviews in light of the recent financial crisis. On the whole, the content of this chapter also provide substantial evidence and backing in the discussion of the empirical convergence results obtained subsequently in Chapters 5, 6 and 7. It can therefore be concluded that the process of deregulation and prudential regulation is an ongoing process, which, as highlighted by the recent financial crisis, needs to be continuously updated so as to meet the needs of an ever-changing and complex banking market. In this vein, the on-coming new supervisory architecture, in the form of supervisory colleges for cross-border banking groups, should aid in the better functioning of a competitive and efficient single banking market, if implemented correctly.

Appendix 3A: List of directives and other initiatives affecting the banking sector

Table 3A.1: List of banking directives

Year	Directive	Objective	Timeframe	Comment
1977	First Banking Directive (77/780/EEC)	Right of entry and establishment for banks from other EC countries.		Incorporated into the Consolidated Banking Directive of 2000
1978/ 1983/ 1989/ 1990/ 2001/ 2003/ 2006	Directive on Annual Accounts (78/660/EEC) / Directive on Consolidated Accounts)83/349/EEC)/ Directive on annual accounts and consolidated accounts of banks and other financial institutions (86/635/EEC).	Harmonised balance sheet requirements and consistent and accurate preparation of consolidated accounts	Spanning over 30 years	Amended several times over the years and lastly by Directive 2006/99/EC which brings all previous directives up-to-date. The latest directive entered into force on 1st January 2007.
1983 /1992	Supervision of Credit Institutions Directive	Establishes the requirement for central banks to supervise credit institutions on a consolidated basis, rather than on a single company basis.		The 1983 directive was replaced by the Directive of Credit Institutions on a consolidated basis in 1992.
1986/ 1990/ 1999/ 2008	Consumer Credit Directive (CCD)	Create a common market for credit in the European Union	Proposal for a revised CCD was put forward in 2002. It took another 6 years before the new CCD was adopted.	The 1986 Consumer Credit Directive was replaced by the 2008 Directive. The transposition deadline was set for June 2010.
1989	Second Banking Directive (89/646/EEC)	Single banking licence for domestic and foreign banks. Requires banks to have minimum capital and establishes some prudential rules.	Entered into force in January 1993	Incorporated into the Consolidated Banking Directive of 2000

Table 3A.1 Cont'd: List of banking directives

Year	Directive	Objective	Timeframe	Comment
1989	Owns Funds Directive (89/299/EEC)	Harmonisation of concept of banks' own funds	Entered into force in January 1993	Incorporated into the Consolidated Banking Directive of 2000
1989	Solvency Ratio Directive (89/647/EEC)	Definition of solvency ratio	Entered into force in January 1993 and amended between 1994 and 2000.	Incorporated into the Consolidated Banking Directive of 2000
1991 /2001	Directive on money laundering (91/308/EEC)	Rules aimed at preventing use of the banking system for the purpose of money laundering	Entered into force in January 1993	Amended in 2001 for a broader coverage and the transposition deadline was June 2003.
1992	Directive on Large Exposures (92/121/EEC)	Monitoring and control of large exposures by credit institutions	Entered into force in January 1994	Incorporated into the Consolidated Banking Directive of 2000
1993 /2006/ 2009	Directive on Capital Adequacy (CRD) (93/6/EEC)	To cover against market risks, foreign exchange risks and other risks	Amended in 1998 /2006 /2009	A new CRD was adopted in 2006 and entered into force in Jan. 2007. The new CRD was amended in 2009 faced with the financial crisis and the changes take effect in Oct. 2010.
1994 /2009	Deposit Guarantee Scheme Directive (94/19/EC)	To ensure that within each member state, guarantee schemes are introduced and officially recognised.	Entered into force in July 1995 /2009/2010.	Amended in 2009. The financial crisis uncovered gaps in the "minimum harmonisation" approach adopted in 1994.
1997	Directive on cross-border credit transfers (97/5/EC)	To enable rapid, transparent, reliable and cheap credit transfers within EU countries. Points such as adequate customer information, and minimum execution requirements are addressed.		Repealed by Directive 2007/64/EC – Payments Services Directive

Table 3A.1 Cont'd: List of banking directives

Year	Directive	Objective	Timeframe	Comment
2004	Directive on Take Over Bids	Harmonise rules on cross-border take-over bids for conducive corporate restructuring.	A proposal for a directive on take over bids was launched in 1989. Since amended versions and discussions have spanned over 15 years.	After lengthy debates, a new proposal was adopted in 2002 but several issues of controversy remain and finally agreement was reached in 2004. The transposition deadline was set for December 2006.
2000 /2006	Directive on the taking up and pursuit of credit institutions (2000/28/EC)	Promote development of credit institutions across the Union		Transposed by all 15 EU member states and is part of the CRD.
2000 /2006	Directive on the taking up, pursuit of and prudential supervision of e-money institutions (2000/46/EC)	Coordinate and harmonise Member States' laws, regulations and administrative provisions relating to the taking up, pursuit and prudential Supervision of the business of electronic money institutions.		Transposed by all 15 EU member states. This directive was amended on several occasions and finally recast in 2006.
2001	Directive on the reorganisation and winding up of credit institutions (2001/24/EC)	Need for mutual recognition for reorganisation measures and winding up procedings.	Adopted after 13 years	The transposition deadline was set for May 2004. In October 2009, the Commission published a communication on a framework for cross-border bank crisis management. This is likely to lead to a revision to this Directive.

Table 3A.1 Cont'd: List of banking directives

Year	Directive	Objective	Timeframe	Comment
2002	Directive on the Distance Selling of Financial Services (2002/65/EC)	Regulates selling contracts of credit cards, etc by phone, fax and the internet.		Had to be transposed by October 2004.
2002	Directive on Financial Collateral Arrangements (2002/47/EC)	Sets out categories of persons who may be party to a financial collateral arrangement and that calculation and valuation of collateral is conducted in sound manner.		The transposition deadline was set for December 2003 but several member states missed the deadline.
2002	Directive on the supervision of financial conglomerates (2002/87/EC)	Development of supplementary prudential legislation on financial conglomerates that addresses present loopholes and prudential risks.		To be transposed by August 2004
2003 /2008	Directive on the taxation of savings income in the form of interest payments	The Directive applies to interest paid to individuals resident in an EU Member State other than the one where the interest is paid. The aim is to avoid the problem of tax evasion.		The transposition deadline was set for January 2005. An amending proposal was adopted in November 2008 to close loopholes and to better prevent tax evasion.
2007	Payment Services Directive	Establish a common framework for payment services across Member States. This directive sets out the legal provisions for the Single Euro Payments Area (SEPA)	The SEPA initiative was launched in 2002.	The transposition deadline was set for September 2009.

Source: Europa online[26] (official journals and other archives)

[26] http://eur-lex.europa.eu//en/index.htm

Appendix 3A

Table 3A.2 Other EU initiatives (either communications or recommendations) for the banking sector

1997	Adoption of recommendation on electronic payment instructions
1997	Simpler Legislation for the Single Market (SLIM) initiative
1999	Launch of Financial Services Action Plan (FSAP)
2001	Voluntary Code of Conduct agreed upon between EU mortgage lending industry and consumer groups
2005	Green paper on Mortgage Credit
2005	White Paper on Financial Services Policy (2005-2010)
2007	White Paper on the Integration of EU Mortgage Credit Markets
2007	Green Paper on Retail Financial Services
2007	Review of single market: "A Single Market for the 21st Century Europe"
2009	Adoption of Communication on Financial Supervision in Europe

Source: Europa online[27] (official journals and other archives)

[27] http://eur-lex.europa.eu//en/index.htm

Appendix 3B

Table 3B.1 Scope of the Second Banking Directive

1.	Deposit-taking and other forms of borrowing
2.	Lending (consumer credit, mortgages, factoring, trade finance)
3.	Financial leasing
4.	Money transmission services
5.	Issuing and administrating means of payment (credit cards, travellers cheques, and bankers drafts)
6.	Guarantees and commitments
7.	Trading for own account or for account of customers in:
	(i) money market instruments (cheques, bills, CDs, etc)
	(ii) foreign exchange
	(iii) financial futures and options
	(iv) exchange and interest rate instruments
	(v) securities
8.	Participation in share issues
9.	Advice to undertakings on capital structure, industrial strategy and related questions, and advice and services relating to mergers and the purchase of undertakings
10.	Money broking
11.	Portfolio management and advice
12.	Safekeeping of securities
13.	Credit reference services
14.	Safe custody services

Note: A bank can provide any of these services in other Member States as long as it is authorised to do so in its home country. This is valid even if a host country does not permit its domestic banks to provide any similar services.

Source: Dixon, 1991 & European Commission, 1999a.

Chapter 4

Research methodology

4.1 Introduction

The aim of this chapter is to introduce and discuss the econometric methodologies chosen to assess the degree of integration in the European retail banking sector. Most existing studies[1] in this area have employed time series analysis while some more recent studies[2] have used panel data analysis to study the convergence process. As suggested by the literature on banking integration, convergence should be perceived as a long-run relationship. Building on this premise, this research employs a multitude of time series and recently developed powerful panel data models to test for European retail banking integration. Firstly, Johansen (1988) cointegration analysis, a technique used to capture the long-term relation between a set of variables is chosen to test for the relationship between the retail interest rates of 15 EU countries. Secondly, considering the fact that the European financial landscape is characterised by heterogeneity across countries, this research employs panel data analysis, which is more informative, has more power and allows for heterogeneity. The methods chosen are the Im, Pesaran and Shin (2003), and Pesaran (2007) panel unit root tests and the recently developed Phillips and Sul (2007) panel convergence and club clustering tests. In addition, in order to avoid wrong inferences being drawn with regards to panel unit root test results, the Bai and Perron (1998) stochastic multiple structural break model is applied to the deposit and lending spread[3] series. The individual spread data series are then subsequently demeaned in

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[1] See Adam et al (2002), Schuler and Heinemann (2002), Kleimeier and Sander (2000, 2003, 2006), Baele et al (2004); amongst others.

[2] Vajanne (2006), Sorensen and Litchtenberger (2007).

[3] Panel unit root tests are applied to spread data (interest rate differential between each deposit/lending rate and the corresponding weighted European average) to test for stationarity.

order to allow for structural change before being tested for convergence. This study is the first one to factor in the effect of structural breaks before applying tests of convergence. The objective is to obtain more robust and conclusive test results. In addition, this test should also provide information on whether the data series are subject to common shocks. These panel methodologies have not been previously used in the context of the EU retail banking sector and their application brings a new dimension to the study of European banking integration. This is especially so in the case of the Phillips and Sul convergence tests which provides a flexible and powerful framework for analysing the convergence process in the banking sector.

4.2 Unit root test of stationarity: the Augmented Dickey-Fuller test

The starting point in this empirical investigation is to test for stationarity in the deposit and lending rates. One of the most popular tests of stationarity is the Augmented Dickey-Fuller unit root test[4]. Consider the following process

$$Y_t = \rho Y_{t-1} + \mu_t \qquad \text{where } -1 \leq \rho \leq 1 \tag{1}$$

If Y_{t-1} is subtracted from both sides, the equation can be written as

$$\Delta Y_t = \delta\, Y_{t-1} + \mu_t \quad \text{where } \delta = (1\text{-}\rho) \tag{2}$$

If the null hypothesis of $\delta = 0$ is tested and found to be true, then the series has a unit root and is therefore a nonstationary stochastic process. If however, δ is negative[5], then

[4] Several unit root tests exist but these vary depending on the size [p(type I error)] and power [p(type I error) – p(type II error)] of their tests. For the DF test, size distortions may occur because this test is sensitive to the way it is conducted, i.e. as a pure random walk or one with a drift or one with a drift and trend. In addition, most DF tests have low power.

the series is stationary. The augmented Dickey-Fuller (ADF) consists of estimating the following regression:

$$\Delta Y_t = \beta + \delta Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-1} + \varepsilon_t \tag{3}$$

Where ε_t is pure white noise and $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$. The ADF test builds on the Dickey-Fuller test which tests for the null hypothesis that $\delta = 0$. However, this test assumes that the error term μ_t is uncorrelated. The ADF test on the other hand consists of adding enough lagged values of the dependant variable ΔY_t until the error term is serially uncorrelated (Gujarati, 2003). Choosing the lag length, *k*, for the ADF test is an important element of the test because on the one hand, if the number of lags chosen is too small, then the remaining serial correlation in the errors will bias the test. On the other hand, if the number of lags chosen is too large, then this may lead to over-parameterization and loss of power (Zivot, 2005, Caporale and Cerrato, 2006). Zivot (2005) further reports that Monte Carlo experiments indicate that it is better to have too many lags than not to have enough.

The two common methods of choosing a lag length are the Akaike Information Criterion and the Schwarz Information Criterion methods. However, Caporale and Cerrato (2006) indicate that these methods tend to select a lag value which is too small. The other method that is often suggested for the lag selection, *k*, is the recursive *t*-statistic procedure proposed by Campbell and Perron (1991). This approach, as argued Ng and Perron (1995), has better power properties than the alternative methods.

The steps for conducting the recursive *t*-statistic procedure are as follows:

[5] Given that $\delta = (1-\rho)$, for stationarity, ρ must be <1. Hence, δ must be negative.

- Set an upper bound for the lag length, k_{max},
- Estimate the ADF regression with the maximum lag length, k_{max},
- Check whether the absolute value of the t-statistic on k_{max} is significant at the 10% two-tail normal distribution i.e. 1.645. If so, set $k = k_{max}$ and perform the unit root test. Otherwise, drop one lag and repeat this process until the t-statistic on the longest lag is significant.

In this research, the method proposed by Campbell and Perron (1991) is used to select the lag length and since the data set consists of monthly series, 12 is chosen as k_{max}

4.3 Johansen (1988) cointegration approach

The most popular method for testing for cointegration is the Johansen (1988) multivariate cointegration approach. In a bivariate model, the number of cointegrating vectors may be zero or one (r = 0,1). The VAR representation given by Johansen is as follows:

$$\Delta \vec{Y}_t = \delta + \Gamma \Delta \vec{Y}_{t-1} + ... + \Gamma_{k-1} \Delta \vec{Y}_{t-k+1} + \Pi \vec{Y}_{t-1} + \vec{\varepsilon}_t \qquad (4)$$

Where

$\vec{Y}_t = (Y_t, X_t)'$,

$\Gamma = -(1 - \Pi_1 - \Pi_2 - .... \Pi_j), j=1,....,k-1$ k= lag length

$\Pi = -(1 - \Pi_1 - \Pi_2 - ..... - \Pi_k)$

$\vec{\varepsilon}_t = (\varepsilon_{1t}, \varepsilon_{2t})'$

Assuming that $\vec{Y}_t$ is a vector of I(1) variables with r linear combinations of $\vec{Y}_t$ being stationary, the matrix Π can be re-written as

$$\Pi \quad = \gamma\beta' \tag{5}$$

where β denotes the matrix of cointegration vectors, while γ is the matrix of weights or the adjustment matrix.

Johansen's (1988) approach estimates equation (4) by maximum likelihood while imposing the restrictions in (10) for a given value of r. In order to test for the number of significant characteristic roots, Johansen (1988) developed a likelihood ratio statistic for the null hypothesis that there is at most r cointegrating vectors which is given by

$$\lambda_{trace} = -T\sum_{i=r+1}^{n} \ln(1-\hat{\lambda}_i) \tag{6}$$

where $\hat{\lambda}_{r+1},\ldots,\hat{\lambda}_n$ are the (n-r) smallest eigenvalues of the determinant equation and r is the number of roots above which the remaining roots are significant. This test is known as the trace test and checks whether the smallest k-r_0 eigenvalues are significantly different from zero.

The other likelihood ratio test by Johansen (1988) is the maximum eigenvalue test which tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of $(r+1)$ cointegrating vectors and is given by

$$\lambda_{\max} = -T\ln(1-\hat{\lambda}_{r+1}) \tag{7}$$

The next step in applying the Johansen method is the selection of the maximum order of lag length for the VAR. Just like for the ADF test, the inclusion of too few lags may result in rejecting the null hypothesis too easily. Hence, the optimal lag length is selected based on the Akaike Information Criterion (AIC).

It should be pointed out that the Johansen approach is generally considered as a better estimation technique than the Engle and Granger method. However, it has been observed that this method does not perform very well in small samples and is sensitive to variables selection and to the number of lags included (Maddala and Kim, 1998).

4.4 Structural break test

Perron (1990) [cited in Garcia and Perron, 1996], argues and proves that if there is a shift in the mean of a series because of structural change, it will be difficult to reject the null hypothesis of a unit root even if the data series appear to be integrated of order 1. Hence to overcome the problem of wrongly detecting unit root, the structural break or breaks have to be identified (Garcia and Perron, 1996). In the context of this research, it must be noted that during the period under investigation, i.e. January 1991-December 2008, there has been significant milestones[6] in the history of the European single market. Therefore it is likely that the deposit and lending spreads[7] corresponding to this period may exhibit structural changes. Furthermore, any tests for structural breaks in the European banking interest spread series would reveal the extent to which the breaks periods coincide with the important events in the European financial integration process. The research also aims at identifying the factors that are responsible for the

[6] 1992 – Maastricht Treaty, 1994-EMU second stage, 1995 –Fourth enlargement round, 1998- ECB is established, 1999- EMU third stage (Baldwin & Wyplosz, 2004), etc.

[7] Deposit/lending spreads represent the differences between each deposit/lending rate and the corresponding weighted European average

structural breaks and finding out if there are any similarities in the break dates for the 15 EU countries. In line with the aims of this research, the Bai and Perron (1998) stochastic multiple structural break model provides a powerful and flexible framework to test for the break dates and their time of occurrence. This method tests for the presence of multiple structural breaks occurring at unknown dates and provides an estimate of the breakpoints. This methodology also allows for general forms of serial correlation, heteroskedasticity in the errors and lagged dependent variables (Bai and Perron, 1998). Drawing from the discussion in Baele (2006) and as per the methodology proposed by Bai and Perron, the deposit or lending spread is regressed on a constant, which is tested for structure breaks. The following regression model with *m* breaks (m+1 regimes) is considered:

$$r_t = \beta_j + \varepsilon_t \tag{8}$$

For j = 1,....., m+1, where r_t is the retail deposit or lending spread in period t and β_j is the mean interest rate level in the *jth* regime. The *m* breakpoints are represented by the partition (T_1,....,T_m) and to estimate the number and timing of the breaks, Bai and Perron have set up a least square algorithm which estimates the least squares estimates of β_j by minimising the sum of squared residuals:

$$S_T(T_1,\ldots,T_m) = \sum_{j=1}^{m+1} \sum_{t=T_{j-1}}^{T_i} (r_t - \beta_j)^2 \tag{9}$$

The estimated breakpoints are given by

$$(\hat{T}_1,\ldots,T_m) = \arg\min_{T_1,\ldots,T_m} S_T(T_1,\ldots,T_m) \tag{10}$$

Where the estimated betas for a given m-partition is given by $\hat{\beta}(T_1,...,T_m)$. Hence the breakpoint estimators represent global minimisers of the objective function (9). To minimise equation (9), Bai and Perron (2003) have put forward an algorithm that is based on the principle of dynamic programming.

In selecting the number of mean breaks (m), Bai and Perron (1998) propose to use the F-statistic (SupF_T (k)) for testing the null hypothesis of no structural break (m=0) against the alternative hypothesis that there are breaks (m=k). Bai and Perron (1998) points out that the test is limited by the nature of the regressors and by the presence or absence of serial correlation and heterogeneity in the residuals. Based on the SupF_T (k), Bai and Perron (1998) derived two double maximum tests, both testing the null hypothesis of no breaks against an unknown number of breaks, given an upper bound M. The first double maximum statistic is given by:

$$UD\max = \max_{1\le m\le M} SubF_T(m). \tag{11}$$

The second test, WDmax, assigns weights to the individual F tests so that the marginal p-values are equal across values of m. Bai and Perron (1998) provide asymptotic critical values of both tests for up to M=5, which should be sufficient for the purpose of this research. The UDmax and WDmax tests help determine whether there are breaks or not. On the next level, Bai and Perron (1998) have developed a SubF_T(m+1/m) to determine the optimal number of breaks. This tests the null hypothesis of m breaks against the alternative m+1 breaks. The critical values for each test statistic SubF_T(m+1/m) are provided by Bai and Perron (1998). With regards to the practical implementation of these tests[8], Bai and Perron (2004) propose to examine the UDmax and WDmax to check for the presence of breaks. If the double maximum statistics are significant, the $SubF_T(m+1/m)$ should be used to determine the number of breaks by selecting the one that rejects the largest value of *m*.

4.4.1 Demeaning of individual spread data series

In order to obtain robust estimates for panel data unit root tests, each individual deposit and lending spread series for the period covering January 1991 to December 2008 is demeaned and thus rendered "break-free" as follows:

$$r_t^* = r_t - \hat{\beta}_j, \tag{12}$$

Where r_t^* is the demeaned retail deposit or lending spread in period t, $t = T_{j-1}+1,\ldots,T_j$, $j=1,\ldots,m+1$ and $\hat{\beta}_j$ $(j=1,\ldots m+1)$ is the estimated mean level of volatility in the *jth* regime.

4.5 Panel unit root tests

In spite of the numerous initiatives towards the creation of a Single Market in banking, the fact remains that there are country-specific variables which, if not taken into consideration, can lead to serious misspecifications. In this respect, in order to allow for the country heterogeneity factors, panel data methods are also used. As Baltagi (2001) pinpoints out, panel data give more informative data, less collinearity among the

[8] The GAUSS program code is available from Pierre Perron's home page at http://econ.bu.edu/perron/.

variables, more degrees of freedom and more efficiency. Over the past decade, several time series unit root tests have been extended to panel data. The most popular ones are the studies by Levin and Lin (1992, 2002), Hadri (1999), Im, Pesaran and Shin (2003) and Pesaran (2007). The panel unit root tests developed by Levin and Lin (1992) tests for the null hypothesis that each series in the panel contains a unit root, i.e. H_0: $\rho = 1$ versus the alternative hypothesis that all individual series in the panel are stationary, i.e. H_1: $\rho < 1$. This method assumes that 1) the coefficient of the lagged dependent variable is homogeneous across all the cross-section units of the panel and 2) the individual processes are cross-sectionally independent (Baltagi, 2001). Hadri (1999) proposes a residual-based Lagrange Multiplier (LM) test for the null hypothesis that the time series for each country are stationary around a deterministic trend against the alternative hypothesis of a unit root in panel data. In this research, the panel unit root tests developed by Im, Pesaran and Shin (2003) and Pesaran (2007) are used to test whether the difference between each country deposit or lending rate and the corresponding weighted European average deposit/lending rate, herein referred to as deposit/lending spreads, is stationary. The presence of stationarity would support the hypothesis of convergence for the EU retail banking savings and lending rates.

4.5.1 The Im *et al* (2003) IPS panel unit root test

The Im, Pesaran and Shin (IPS) unit root test is chosen because it does away with the restrictive assumption in the Levin and Lin test that requires ρ to be homogeneous across *i*. The IPS test allows for a heterogeneous coefficient of $y_{i,t-1}$ and proceeds to compute an average of the ADF tests for each series within a dynamic panel. This is referred to as the *W-stat* test. The test allows for residual serial correlation and heterogeneity of the dynamics and error variances across groups.

The IPS framework assumes a stochastic process, y_{it}, which can be represented by ADF (without trend) as follows:

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + \sum_{j=1}^{p_i} p_{ij} \Delta y_{i,t-j} + \varepsilon_{it} \tag{13}$$

The null hypothesis[9] is

$H_0 : \beta_i = 0$ for all i

And the alternative hypothesis is

$H_1 : \beta_i \prec 0, \quad$ i = 1,2,.....,N

The first step in the IPS unit root test is the t-bar statistic which is formed as an average of the individual t statistic for testing $\beta_i=0$ and is written as

$$\bar{t}_{NT} = \frac{1}{N} \sum_{i=1}^{N} t_{iT}(p_i) \tag{14}$$

Where t_{iT} are the individual ADF t-statistics for the unit root tests and p_i is the lag order in the ADF regression.

[9] Note that in the case that the null hypothesis is rejected, the results do not provide any information on the identity of the particular panel members for which H_0 is rejected.

Th second step in the IPS test is the standardised t-bar statistics, the Z_{tbar} which assumes that as T $\rightarrow \infty$, the individual ADF statistics converge to η_i, the Dickey-Fuller distribution.

The test is given as

$$Z_{tbar} = \sqrt{N(T)} \frac{\bar{t}_{NT} - E(t_{iT})}{\sqrt{Var(t_{iT})}} \qquad (15)$$

Where critical values for $E[t_{iT}(p_i,0)]$ and $Var[t_{iT}(p_i,0)]$ are obtained by Monte Carlo simulations.

The IPS test was subjected to various Monte Carlo simulations and the main findings reported by the authors are that when there are no serial correlation, the t-bar test performs very well even when T=10. However, when the disturbances in the dynamic model are serially correlated, the t-bar test procedures requires that both T and N are sufficiently large. In this research, T=144 and 63 and N=15. In addition, Im et al (2003) argue that in the presence of serially correlated errors, it is critical not to underestimate the order of the underlying ADF regressions. In the simulations conducted, the authors found that if a large enough lag order was selected for the underlying ADF regressions, the performance of the t-bar test was reasonably satisfactory (Im *et al*, 2003).

4.5.2 Pesaran's (2007) CIPS unit root test

One of the assumptions of most of the panel unit root tests, including that of Im et al (2003) is to assume that the individual time series in the panel are cross-sectionally independently distributed. To circumvent this restrictive assumption, it has been common practice to apply cross-section demeaning before running the panel unit root tests. However, as reported by Pesaran (2007), this approach is not effective when pair-wise cross-section covariances of the error terms differ across the individual series. In order to address this problem, Pesaran (2007) proposes a panel unit root test which allows for cross-sectional dependence by augmenting the ADF regressions with the cross section averages of lagged levels and first-differences of the individual series. Once the averages of the individual cross-sectionally augmented ADF statistics (termed as CADF) are computed, standard panel unit root tests, such as a modified IPS (2003) [termed as CIPS], can then be applied[10].

The CADF regression is described as:

$$\Delta z_{it} = a_i + b_i z_{i,t-1} + c_i \bar{z}_t + d_i \Delta \bar{z}_t + e_{it} \tag{16}$$

Where $\bar{z}_t = N^{-1} \sum_{i=1}^{N} z_{it}$ is the cross-section mean of z_{it}

The test for the null hypothesis $H_0 : \beta_i = 0$, for all i, against $H_1 : \beta_1 < 0$; $\beta_{N0} < 0$, $N_0 \leq N$, is given by the average of the individual CADF statistics, i.e. the CIPS test:

$$CIPS\,(N,T) = N^{-1} \sum_{i=1}^{N} t_i(N,T) \tag{17}$$

[10] The CIPS Gauss code have been written and provided by Yamagata (2006).

Where $t_i(N,T)$ is the cross-sectionally augmented Dickey-Fuller statistic for the i^{th} cross section unit given by the *t*-ratio of the coefficient of $z_{i,t-1}$ in the CADF regression The distribution of the CIPS test is non-standard and the critical values for 1%, 5% and 10% have been tabulated by Pesaran (2007) for different combinations of N and T.

4.5.3 Diagnostic test for cross-section dependence in the panel datasets

Before applying the CIPS test, it is useful to test whether cross-section dependence in the panel sets is actually present. The diagnostic test developed by Pesaran (2004) is chosen as this test is applicable to a variety of panel data models, including unit root heterogeneous panels. Pesaran's (2004) cross-section dependence (CD) test is based on the average of all pair-wise correlation coefficient of the Ordinary Least Squares residuals from the individual regressions in the panel. The CD test can be used to test for cross-section where 1) there is a fixed order *p*, or 2) no ordering of the cross section units is assumed. Pesaran (2004) also proves that the CD test is robust to single or multiple breaks in the slope coefficients and/or in the error variances of the individual regressions. The null hypothesis considers zero cross-dependence in the panel while the alternative considers the opposite. The CD test has a standard normal limiting distribution and is computed as follows:

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N} Corr\,(\hat{\varepsilon}_i, \hat{\varepsilon}_j)\right) \Rightarrow N(0,1) \tag{18}$$

$\hat{\varepsilon}_i$, i=1,....N, is a (Tx1) vector of estimated residuals.

4.6 Phillips and Sul (2007) panel convergence test

A major contribution of this study is the application of the recently developed regression-based test of convergence by Phillips and Sul (2007a)[11] and applied in Phillips and Sul (2007b, 2009). This test of convergence, termed as the *logt test*, is ideally suited for this research for the following reasons. Firstly, this methodology provides an empirical modelling of long run equilibria within a hetereogenous panel, outside of the co-integration setup. Secondly, this methodology can provide an estimate of the speed of convergence and can also cluster panels into club convergence groups. This test would thus not only be able to reveal whether any convergence is present within the European banking sector of the EU15 countries but the clustering algorithm will, in turn, detect whether any specific group of countries are converging or diverging. Thirdly, the test does not necessitate any specific assumptions regarding the stationarity of the variables and allows for cases where individual series may be transitionally divergent.

In addition, this model is based on a time varying factor representation. These are key aspects of the Phillips and Sul (2007a) model as it does away with the restrictions faced with standard unit root and cointegration tests whereby the presence of long-run equilibrium can be rejected because of shorter data panels due to data limitations. For instance, cointegration will not be detected in cases whereby the variables of interest may be converging over time but the speed of convergence is not fast enough to reflect cointegrated behaviour. The Phillips and Sul model will be able to detect the presence of co-movement and convergence. This methodology can thus be described as an

[11]The Gauss codes for the computation of the logt test and convergence clubs are available from Sul's website http://homes.eco.auckland.ac.nz/dsul013/.

asymptotic cointegration test that models long run equilibrium while allowing for individual heterogeneity which can evolve over time.

In comparison with other convergence models such as the popular concepts of β- and σ-convergence derived from the growth literature and developed by Barro (1991) and Barro and Sala-i-Martin (1992), the Phillips and Sul (2007) model offers some strong advantages. Beta-convergence is intended to measure the speed of convergence by looking at the mean reversion for the panel units whereby a resulting negative β would signify convergence. Sigma convergence, on its part, measures the degree of convergence and is expected to increase as the cross-sectional standard deviation of the variables trends downward. Thus, full convergence is said to be achieved when the standard deviation converges to 0. However, as argued by Morris (2009) one major limitation of sigma convergence is that the method underpinning the selection of the groups of countries for club-convergence tests is unclear as the selection seems to be based on "ad hoc groupings".

Furthermore, another drawback which is also shared by the concept of beta convergence is that none of these convergence methods enables the analysis of the behaviour of each individual country series over time. Furthermore, as indicated by Islam (2003), β- and σ- convergence are more relevant within the context of growth literature and he also uncovers problems that arise when empirical analysis of convergence are conducted. Consequently, the Phillips and Sul (2007) methodology brings two important contributions to the study of convergence within the retail European banking. Firstly, their coefficient factor-model allows for variation over time and across countries which is particularly relevant in the context of this research. Secondly, their methodology also allows for the computation of each country's relative transition parameter which provides information on the country's behaviour relative to the panel cross-section average over time. This is very significant as it would not only depict the convergence patterns of the countries throughout the whole time period but also uncover situations where individual countries may be diverging even if as a whole group, convergence is detected.

Within the context of the European financial market, a few recent studies have used the Phillips and Sul (2007) model namely, Caporale et al (2009) who investigate convergence in stock returns for 5 EU countries; Antzoulatos et al (2008) who analyse the convergence of non-interest income in the EU countries; Higson et al (2009) who explore the convergence in the European equity markets; and Fischer (2009) who measures price convergence in the European Monetary Union. So far, within the context of European retail banking integration, most studies that have performed panel convergence analysis have applied β- and σ- convergence tests (see Murinde et al (2000), Adam et al (2002), Baele et al (2004) and Vajanne (2007)).

4.6.1 Relative transition paths

Panel data for a variable X_{it} can normally be decomposed into two components comprising systematic components, g_{it}, and transitory components, a_{it}, as follows:

$$X_{it} = g_{it} + a_{it} \qquad (19)$$

The main procedure in the Phillips and Sul convergence test is to calculate the time-varying loadings, g_{it} and to do so, Phillips and Sul (2007a) reformulates equation (19) such that common and idiosyncratic components are separated as follows:

$$X_{it} = \left(\frac{g_{it} + a_{it}}{\mu_t} \right) \mu_t = \delta_{it} \mu_t \qquad \text{for all } i \text{ and } t, \tag{20}$$

Where μ_t is a single common component and δ_{it} is a time varying idiosyncratic element. Hence, δ_{it} measures the economic distance between the common trend component μ_t and X_{it}. To test whether the components of δ_{it} are converging, Phillips and Sul (2007a) define the transition coefficient as h_{it} and information about the time varying factor loadings δ_{it} can be extracted as follows:

$$h_{it} = \frac{X_{it}}{\frac{1}{N}\sum_{i=1}^{N} X_{it}} = \frac{\delta_{it}\mu_{it}}{\frac{1}{N}\sum_{i=1}^{N} \delta_{it}\mu_{it}} = \frac{\delta_{it}}{\frac{1}{N}\sum_{i=1}^{N} \delta_{it}} \tag{21}$$

The so-called *relative transition parameter* h_{it} measures δ_{it} in relation to the panel average at time t and therefore describes the transition path for country i relative to the panel average. Moreover, the convergence process can be graphically illustrated by plotting the transition parameter for each country over time.

However, macroeconomic variables often contain business cycle components which render the representation in (20) inappropriate. Hence, following Phillips and Sul (2007a) recommendation, the Hodrick-Prescott (1997) filter is used to filter out the cycle component in the interest rate data series and then work out the filtered transition coefficients $\hat{h}_{it}$. Hodrick and Prescott (1997) demonstrate that higher frequency data require a higher value for the smoothing parameter. In this research the value of lamda is set to 14400, as suggested in the literature[12] for monthly data.

4.6.2 The Log *t* regression

The log *t* regression test of convergence tests for the null hypothesis of convergence

$$H_0 : \delta_i = \delta \text{ and } \alpha \geq 0$$

Against the alternative

$$H_1 : \delta_i \neq \delta \text{ for all } i \text{ or } \alpha < 0$$

Phillips and Sul's (2007) procedure involves three steps, as listed below.

Step 1: The cross sectional variance ratio $\frac{H_1}{H_t}$ is calculated as follows:

$$H_t = \frac{1}{N}\sum_{i=1}^{N}(\hat{h}_{it} - 1)^2 \tag{22}$$

Step 2: The following OLS regression is performed:

$$Log\left(\frac{H_1}{H_t}\right) - 2\log L(t) = \hat{a} + \hat{b}\log t + \hat{u}_t \tag{23}$$

Where L(*t*) = log(*t*+1) and the fitted coefficient of log *t* is $\hat{b} = 2\hat{\alpha}$, where $\hat{\alpha}$ is the estimate of α

[12] For instance, in Eviews, the default value for lamda is 14400 for monthly data.

in H_0. The data for this regression starts at t =[rT] with some r > 0. Based on the results of their Monte-Carlo simulations, Phillips and Sul (2007a) recommend r = 0.3.

Step 3: A one-sided t test of null $\alpha \geq 0$ using $\hat{b}$ and a standard error estimated using a heteroskedasticity and autocorrelation consistent (HAC) estimator. The test statistic $t_{\hat{b}}$ is normally distributed and hence at the 5% level, the null hypothesis of convergence is rejected if $t_{\hat{b}}$<-1.65.

4.6.3 Club convergence algorithm

Following Phillips and Sul (2007a) argument that a strict rejection of the null of convergence may not necessarily rule out the existence of sub-group convergence within the panel, the authors have developed a club convergence algorithm to detect such units of clusters. In the scope of this research, this methodology will bring new insight into the convergence process within the EU15 retail banking sector by revealing whether clusters of convergence are present. If present, then the relationship within the clusters based on economic or structural characteristics can be further explored.

Phillips and Sul (2007a) clustering algorithm is based on repeated log t regressions and contains four main steps which are described below.

Step 1: The X_{it} series in the panel are ordered according to the last observation, X_{iT}.

Step 2: A core group is formed by selecting the first k highest panel members to form the subgroup G_k for some N> $k \geq 2$ and the convergence test statistic $t_{\hat{b}}(k)$ is calculated for each k. The core group size k^* is chosen by maximising $t_{\hat{b}}(k)$ under the condition that $\min\{t_{\hat{b}}(k)\} > -1.65$.

Step 3: Once the core group is formed, each remaining country is then added separately to the core group and the log t test is run. If the corresponding test statistic, $t_{\hat{b}}$ is greater than a chosen critical value, c[13], then the country is included in the current subgroup to form a new group. The log t test is run for this subgroup and if $t_{\hat{b}}$ is > -1.65, the formation of this subgroup is completed. Otherwise, the critical value c is raised and the procedure is repeated.

Step 4: The log t test is run on the group of countries not selected in step 3 and if convergence is detected within this new cluster, a second club is formed. Otherwise, in the case of rejection, steps 1, 2 and 3 are repeated on the remaining countries. If no other subgroups can be detected, it can be concluded that the remaining countries diverge.

4.7 Data sets and variable definitions

19 monthly deposit and lending interest rate data sets for two specific sectors, non-financial corporations and households have been compiled for up to 15 EU countries[14] for the purpose of this research. Due to limited availability of data for the other EU countries, the empirical analysis conducted in this thesis focuses on the group of 15 EU

[13] Phillips and Sul (2009) suggest setting c to zero when T is small to ensure that it is highly conservative. However, for large T, c can be set at the asymptotic 5% critical value of -1.65. Given that the number of observations in this research ranges from 72 to 142, c is set at 0.

[14] Austria (AT), Belgium (BE), Denmark (DK), Germany (DE), France (FR), Finland (FR), Italy (IT), Ireland (IE), Greece (GR), Luxembourg (LUX), Netherlands (NL), Portugal (PT), Spain (ES), Sweden (SE) and the United Kingdom (UK).

member states only. Several of the data sets have been compiled into two sub-periods. The first period starts in January 1991 or April 1995 and ends in December 2002. The majority of the interest rate data for this sub-period has been sourced from the ECB's (European Central Bank) database entitled "National Retail Interest Rates" and some missing data has been supplemented by data from the IMF, the Central banks and Datastream. The ECB discontinued this database in 2002 and replaced it by a more harmonised database entitled "MFI Interest rates" which starts in 2003 and runs to-date. The second sub-period starts in January 2003 and ends in December 2008. The bulk of the data series in the second sub-group have been sourced from the ECB's new harmonised database and the remaining data supplemented by data obtained from central banks.

The following datasets[15] have been compiled for the non-financial corporations sector:

- Short-term lending rates (1991-2002)
- Lending rates with up to 1 year; 1-5 years; and over 5 years maturities, respectively (2003-2008)
- Bank overdrafts (2003-2008)
- Deposit rates with up to 1 year; 1-2 years; and over 2 years maturities, respectively, (2003-2008)

For the household sector, the following datasets have been compiled:

- Short-term deposit rates (1991-2002)
- Consumer loans (1995-2002)

[15] Additional information on the data series are provided in Chapters 5 and 6.

- Mortgage rates with 2-5 years maturities (1995-2002)
- Mortgage rates with 1-5 years; 5-10 years; and over 10 years maturities, respectively (2003-2008)
- Consumer credit with up to 1 year; and 1-5 years maturities, respectively (2003-2008)
- Deposit rates with up to 1 year; 1-2 years; and over 2 years maturities, respectively (2003-2008)

In order to test for cointegration and panel unit root tests, 19 series of European average deposit and lending rates were constructed using as weights the share of each country's GDP in the total EU15 GDP (all measured at constant prices and constant purchasing power parities)[16]. For the 1991-2002 data series, the 1998 GDP figures were used to construct the weights, whereas for the 2003-2008 data series, the 2005 GDP figures were used. These weights are shown in Table 4A.1 in Appendix 4A.

4.8 Conclusions

The aim of this chapter is to discuss the time series and panel data methodologies chosen to conduct an empirical analysis of the integration process in the European retail banking sector. These are the Johansen (1988) cointegration analysis, the Bai and Perron (1998) stochastic multiple structural break model, the Im, Shin and Pesaran (2003) and the Pesaran (2007) panel unit root tests and finally the Phillips and Sul (2007) convergence tests. These methodologies, which are at the same time powerful

[16] For an application of this methodology to the construction of European weighted average interest rates see, among others, Kleimeier and Sander (2003, 2006). This methodology is based on the OECD measures of GDP in US$ at constant prices and constant PPPs with 2000 as the reference year.

and flexible, have not, up to now been employed in the area of European banking and thus contribute substantially to this area of research.

Appendix 4A: GDP Weights for European averages

Table 4A.1: Weights used for the construction of the European average rates for the period 1991 -2008

Country	Year: 1998		Year: 2005	
	GDP(m)	Weight	GDP(m)	Weight %
Austria	214934	2.4	250139.3	2.4
Belgium	263006.2	3.0	305766.7	3.0
Denmark	144731.5	1.6	163564.2	1.6
Finland	121550.4	1.4	150200.6	1.4
France	1428065.2	16.1	1664858.7	16.1
Germany	2023289.9	22.7	2194773.2	21.2
Greece	185802.7	2.1	246637	2.4
Ireland	90000	1.0	142675.8	1.4
Luxembourg	19884.4	0.2	27862.9	0.3
Italy	1383598.4	15.6	1519830.8	14.7
Netherlands	429787.6	4.8	499341.3	4.8
Portugal	161718.9	1.8	182288.6	1.8
Spain	779239.8	8.8	1006878.1	9.7
Sweden	225264.6	2.5	279064.1	2.7
UK	1426147.1	16.0	1729709.9	16.7
Total	8897020.7	100.00	10363591.2	100.00

Notes: 1) The weights are based on GDP US$ at constant prices, constant PPPs with reference year 2000; 2) For those data sets which do not have data for all the EU15 countries, the weights have been reconstructed.

Source: OECD Database

Chapter 5

Convergence of deposit and lending rates to the household sector

5.1 Introduction

As part of the wider aim for a Single Market for financial services which was launched in 1992, a single market for EU banking was viewed as pivotal by the European Commission. The aim was to facilitate the establishment of pan-European providers of financial products, generate greater consumer choice, and boost efficiency and competition, amongst others. At the time, major regulatory and institutional reforms were launched and have been revised and reformulated over the years to keep up with an ever-changing and dynamic market. Hence, the aim of this chapter is to investigate how successful these initiatives have been in creating an integrated European retail banking sector by analysing various monthly deposit and lending rates for the household sector for the period 1991 to 2008. Given the importance of the household sector as a component of retail banking, it is believed that a thorough analysis of deposit, consumer credit and mortgage rates with varying maturities can paint a true picture of the convergence process in European retail banking.

The main contributions of this chapter are fourfold. Firstly, it presents a detailed analysis of the convergence process in the retail banking market for both the 1990s and the more recent period, 2003 to December 2008, thus enabling a comparison between the new millennium and the 1990s. Secondly, this study is the first one which factors in the presence of structural breaks in each country's deposit and lending spreads before applying a set of convergence tests to these rates[1]. The multiple stochastic structural break model developed by Bai and Perron (1998) is used for this purpose and each data set of deposit and lending spreads is subsequently demeaned in order to remove the effect of structural breaks, which, as discussed in Chapter 4, can lead to wrong conclusions being drawn if not accounted for. Hence, the objective here is to obtain more robust and conclusive test results. Thirdly, the pattern of these breaks are analysed to detect whether the countries' data series have been subject to common shocks such as key regulatory changes. Fourthly, another major contribution of this chapter is the application of a recently developed powerful panel convergence methodology, namely the Phillips and Sul (2007) convergence test, which has not been previously employed in this area. Time series analysis is also part of the methodology in order to provide a solid and enveloping investigation and to also be able to draw parallels between the results obtained under different methods and with the existing literature.

The structure of this chapter is as follows: section 5.2 gives an overview of the European household sector while sections 5.3 to 5.10 analyse the empirical results obtained under the Augmented Dickey-Fuller unit root tests, the Johansen cointegration tests, the Bai and Perron structural break tests, the Im, Pesaran and Shin and the Pesaran panel unit root tests, and the Phillips and Sul log-*t* and club clustering tests. Section 5.11 concludes.

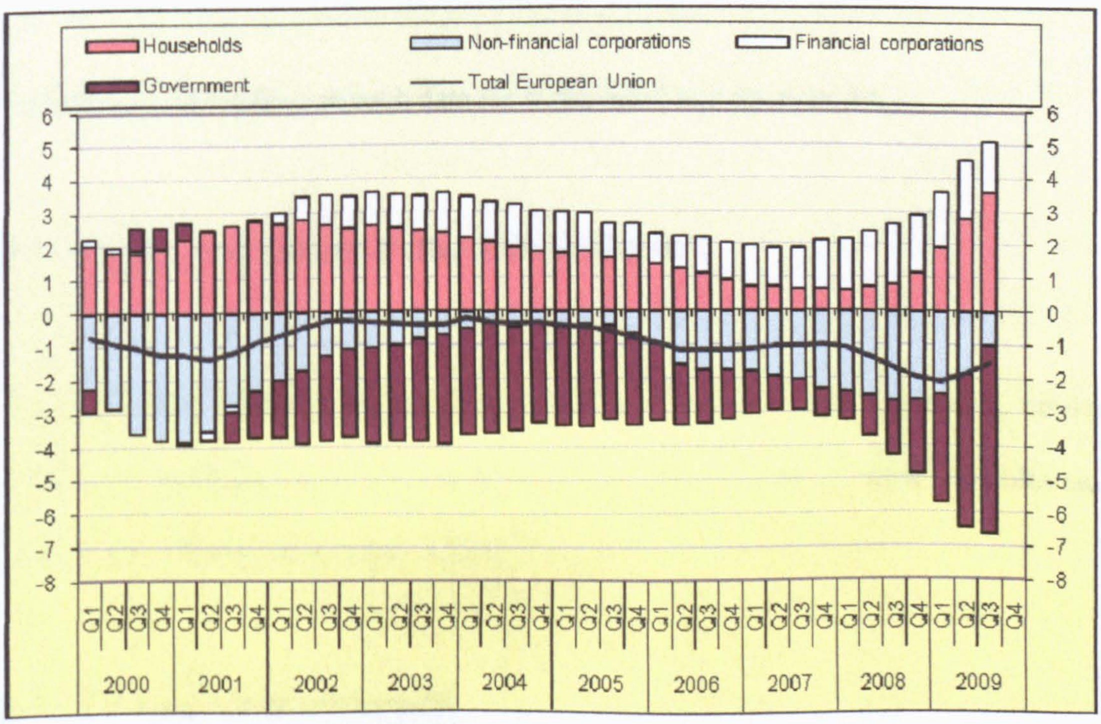
[1] Sander and Kleimeier (2000) is the only other study that applies structural break tests to lending rates and nominal spreads but simply splits the sample period into two as a means of accounting for structural change.

5.2 The household sector

The integration of the EU households' savings, consumer credit and mortgage markets lie at the heart of the EU's objectives for a unified retail banking market. The main goals of the initiatives pursued so far have been to foster competition, promote efficiency, create a more harmonised market place and deliver consumer protection and greater choice. These initiatives, which have been discussed at length in Chapter 3, are constantly being revised and reformulated given the ever-changing market place and the substantial role that the household sector plays within the EU economy.

Indeed, within the euro area, the share of net savings from the households sector stands at almost 81%, based on 1999-2008 averages while the contribution of this sector, as a percentage of GDP, to net lending and borrowing of the European union is the highest (see Figure 5.1) (Eurostat, 2009). As for the mortgage market, it has been estimated that outstanding residential mortgage lending in the 27 EU Member States was over 50.1% of EU GDP while outstanding consumer credit lending in the EU27 stood at 7.7% of EU GDP as at 2007 (European Commission, 2009). The amount of household credit (including consumer credit, mortgage loans and other credit) has increased during the financial crisis and was estimated to be almost EUR 5 billion in the first quarter of 2010, up from EUR 4.8 billion in 2007 (ECB Database, 2010). In fact, the recent financial crisis role has further exposed the vulnerability of the household sector. As reported by the ECB (2009c), household credit risks have been adversely affected by the slower pace of economic growth; a difficult labour market; tighter lending conditions; and in some countries, a decline in house prices which would bring some households into negative equity. The effects on the retail banking sector are serious due to the resulting higher default risks and risks to banks' collateral values combined with a declining consumer confidence. Some of the effects of the crisis should be captured by the analysis in this thesis as the sample period goes up to the end of 2008. On the whole, an analysis of households deposit and lending rates for consumer credit and residential mortgages should provide a thorough and detailed insight into the convergence process in the European retail market.

Figure 5.1 Contributions of sectors to the net lending (+) / net borrowing (-) of the European Union



Source: Eurostat 2009

The methodologies introduced in Chapter 4 are applied to the following 11 datasets which have been constructed for the 15 EU[2] countries:

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[2] Austria (AT), Belgium (BE), Denmark (DK), Germany (DE), France (FR), Finland (FR), Italy (IT), Ireland (IE), Greece (GR), Luxembourg (LUX), Netherlands (NL), Portugal (PT), Spain (ES), Sweden (SE) and the United Kingdom (UK).

- Short-term deposit rates (1991-2002)
- Deposit rates with up to 1 year; 1-5 years; and over 2 years maturities, respectively (2003-2008)
- Consumer credit rates (1995-2002)
- Consumer credit rates with up to 1 year; and 1-5 years maturities, respectively (2003-2008)
- Mortgages rates with 2-5 years maturities (1995-2002)
- Mortgages rates with 1-5 years; 5-10 years; and over 10 years maturities, respectively, (2003-2008).

Additional information on each data set is provided in Appendix 5A.

5.3 Augmented Dickey-Fuller Unit root tests

The ADF test results, as reported in Appendix 5B, show that the deposit, consumer credit and mortgage rates to households have a unit root. Hence, these variables can be entered in a cointegration relationship.

5.4 Cointegration test results

The Johansen VAR cointegration model with intercept but no trend is used to perform the cointegration analysis. The lag order for each VAR model, which includes each country's deposit, consumer credit or mortgage rate and the corresponding European weighted average rate, is selected according to the Akaike Criterion. The trace and maximum eigenvalue test statistics are obtained at the 1% and 5% significance level and are reported in Appendix 5C.

5.4.1 Cointegration results for the deposit rates to households

The cointegration tests have yielded some very interesting and insightful results for the deposit data sets. On the basis of this information, conclusions on the integration process in the European retail banking can be formulated. With regards to the 1991-2002 short-term deposit rates, the presence of cointegration is detected for just 6 out of 14[3] EU countries, namely Belgium, Germany, Greece, Portugal, Sweden and the UK. As for the 2003-2008 deposit rates with 1-year maturity, the level data series show the presence of cointegration for only one country, Sweden while the remaining 14 countries show no cointegration. The deposit rates with 1-2years and over 2 years maturities show very similar results too. For the 1-2 years deposit rates, cointegration is detected for only 3 countries, namely Belgium, Finland and Italy while no cointegration is revealed for the remaining 12[4] countries. As for the deposit rates with over 2 years maturity, only 2 countries, Belgium and Spain, show the presence of one cointegration equation while for the remaining 12[5] countries, no cointegration is detected.

Based on the cointegration findings for the deposit rates for the period 1991-2002, the following observations can be put forward. Firstly, the cointegration results show that the European consumer savings market is far from being fully integrated. In addition, it can be observed that there are higher numbers of cointegrating equations for the 1990s

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[3] AT, BE, DE, DK, ES, FI, FR, IE, IT, GR, PT, NL, SE, UK
[4] AT, DE, DK, ES, FR, GR, IE, LUX, NL, PT, SE, UK
[5] AT, DE, DK, FI, FR, GR, IE, IT, NL, PT, SE, UK

short-term deposit rates than for the 2003-2008 short term and medium-term deposit rates.

This lack of integration in the deposit rates would lend support to the often cited assertion that cross-border European retail banking sector is fragmented and faces major hurdles in the form of supply-side factors such as varying national banking characteristics and demand side factors such as consumer inertia. For example, on the banking structures, in some countries such as the Netherlands and the UK, the banking sector is dominated by large oligopolistic national players while in Germany and Spain, the landscape is characterised by a large number of small regional banks. More specifically, in these two countries, savings banks account for 30% to 50% of retail activities. In other member states such as Austria, Sweden, Italy, France, savings banks have a much less prominent role to play within the retail banking sphere. In addition, savings banks in Germany and Spain have to uphold social obligations and therefore channel funds to community and social projects. In Spain, the savings banks must allocate at least half of their profits to reserves and the rest to social projects. Similarly in Germany, savings banks' profits which are not allocated to reserves have to be used for welfare projects (European Commission 2007b).

In other countries such as the Netherlands and Italy, it is cooperative banks that have significant market share in the domestic retail banking sector. For example, in the Netherlands, Rabobank, a large cooperative bank, takes almost 40% of all private savings. In Germany, there are around 1300 cooperative banks which, alongside the savings banks, are also major players in the German retail banking sector. Furthermore, the ownership structure of cooperative banks (vote limitations) and to a lesser extent, savings banks, is such that it is extremely difficult for any of these banks to be taken over by foreign banks (European Commission, 2007b). For example, in Italy, the number of foreign-owned banks out of the total number of commercial banks is around 24%[6]. However, the number of cooperative banks (around 480) is even higher than the number of commercial banks (around 325) (OECD, 2010). In Germany, the proportion of foreign-owned commercial banks is around 25%[7] but this is greatly outpaced by the number of savings banks (around 450) and cooperative banks (around 1200) (OECD, 2010). Furthermore, in Germany, over 40% of retail assets are held by publicly owned banks and unless the domestic laws are changed, the status quo will be maintained (Centre for European Reform, 2007). In addition, there tends to be close ties between savings and cooperative banks in countries that are traditionally dominated by such banks.

Another supply-side factor which illustrates the heterogeneity in the European savings market is the product diversity that exists. For instance, in its inquiry into retail banking, the European Commission (2006d) reported that several member states such as Belgium, France, and Denmark and to a lesser extent, Portugal, the UK, the Netherlands, Sweden, Spain, Ireland, and Germany all offered some kind of tax incentives on savings accounts. For example, up to May 2007, only 3 French banking groups, namely Banque Postale, Caisse d'Épargne and Crédit Mutuel, could exclusively offer tax-exempted savings accounts (Livret A and Livret Bleu) in France[8] (Europa, 2009). In Belgium on its part, interest paid on savings accounts by domestic banks is tax-exempted while interest paid by foreign banks is not[9] (Europa, 2010). These tax incentives would undoubtedly

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[6] Based on OECD data for 2007 (OECD, 2010)
[7] Based on OECD data for 2007 (OECD, 2010)
[8] Following proceedings by the European Commission, France has now put an end to the selective distribution of these tax-exempted savings accounts.
[9] In May 2010, the European Commission has decided to refer Belgium to the European Court of Justice in order for these tax provisions to be amended.

influence consumers when they choose which credit institution or country to use to open their savings or deposits accounts.

On the demand side, the lack of customer mobility within the EU retail banking sector could be attributable to the existence of switching costs which encompass administrative costs, information asymmetry, lack of price transparency and risk-aversion, amongst others. More specifically, a customer may be reluctant to use a bank located in another member state due to complex information on pricing and structure of retail financial products and/or if domestic credit institutions are favoured because of greater trust and the importance of bank relationship.

Another possible reason that could explain the low level integration of deposit rates could be the fact that some banks in Member States tend to engage to a large extent in product tying and bundling[10]. Such a strategy is often pursued to increase cross-selling activities or to bring in more customers but is regarded as being anti-competitive as it can reduce price transparency and comparability (European Commission, 2006). Based on the findings by the European Commission (2006d), Greece was attributed a tying percentage of 83% whereby customers requiring a mortgage were also required to open a current account. Spain, on its part, also has a high tying percentage at 86%, while for Italy and Luxembourg, it stood at 69% and 50% respectively. The percentage of tying was also high for customer loans and current accounts for Luxembourg (100%), Netherlands (75%), Italy (77%), Spain (75%), and Greece (50%).

[10] Product tying occurs when two or more products are sold together while one of the products is not sold separately while product bundling occurs when two or more products are sold together in a package while each product is also sold separately (European Commission, 2007b)

Overall, it can be observed that the degree of fragmentation within the EU retail banking sector for the deposit rates can be explained by a plethora of banking structures, an unequal balance between the leading domestic and foreign banks, varied distribution models, customer inertia and immobility, the importance of customer-bank relationship and the reliance on branch networks, amongst others. These elements could act as impediments to a deeper integration within the EU retail deposit banking market.

5.4.2 Cointegration results for the consumer credit rates

Along the same vein as the cointegration results for the deposit rates, the cointegration results for the consumer credit rates provide some interesting information on the European market for consumer credit. With regards to the 1995-2002 consumer credit rates, the data series for six countries, namely Austria, Germany, Finland, France, Sweden and UK, test positive for cointegration with the weighted European average while the remaining 3 countries (Belgium, Spain, and Portugal) show no cointegration. As for the consumer credit rates with 1-year maturity for the period 2003-2008, six[11] out of the 15 countries show the presence of cointegration while the remaining nine[12] countries do not. The consumer credit rates with 1-5years maturity for the period 2003-2008 show a similar picture with cointegration detected for seven[13] out of the 15 countries. Based on the cointegration results for the consumer credit rates, it can be argued that the convergence process in consumer credit is limited.

[11] AT, BE, DK, GR, IE, LUX
[12] DE, ES, FI, FR, IT, NL, PT, SE, UK
[13] AT, BE, DK, FR, LUX, NL, PT

5.4.3 Cointegration results for the mortgage rates to the household sector

The cointegration results for the mortgage rates to the household sector provide a mixed picture of the convergence process within the residential mortgage market over the period 1995 to 2008. For the level data series for the period 1995-2002 (2-5 years maturities), the presence of cointegration is detected for 8[14] out the 13 countries in the sample. The results for the 2003-2008 mortgage data-set with 1-5years maturities show the presence of cointegration for only 3 out of the 15 countries in the sample, namely Germany, Finland and France. As for the mortgage rates with 5-10 years maturities for the period 2003-2008, the presence of cointegration is very weak. Only 2 countries (Austria, Finland) out of 15 test positive with one cointegration equation when level data is tested. With regards to the mortgage rates with maturities over 10 years for the period 2003-2008, the results obtained are again revealing. All the 11[15] countries in the sample show a total absence of cointegration.

Based on the cointegration results on the mortgage data sets, it can, firstly, be observed that the integration process started well in the 1990s for instruments of short maturities in the mortgage market with almost 62% of the countries in the sample testing positive for cointegration. These findings tally with those of Adam et al (2002) and Baele et al (2004) who measure the degree and speed of integration in the mortgage market[16] in the 1990s and find that the mortgage market is indeed integrated. However, Adam et al (2002) also discover that the speed of convergence is rather slow in this market during this period and attribute this to institutional differences and local factors which have an important bearing on the housing market.

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[14] AT, BE, DE, FI, FR, IT, NL, LUX
[15] AT, BE, DE, ES, FI, FR, GR, IT, NL, UK, DK
[16] β and σ convergence tests are applied to national averages of fixed-term standard mortgage rates.

Secondly, it can be observed that almost no integration is detected for the 2003-2008 short-term (1-5 years) as well as longer term (5-10 years and over 10 years) mortgage series. These results are somewhat different to those of Vajanne (2007) and Sorensen Lichtenberger (2007), who find that the mortgage market for shorter-term instruments is actually more integrated that the mortgage market for longer term instruments.

Overall, the cointegration tests portray a picture of weak convergence in the savings and lending markets in the European Union for both periods: 1990-2002 and 2003-2008. These results are in line with findings from similar studies[17] which find evidence of fragmented integration in the EU retail banking sector.

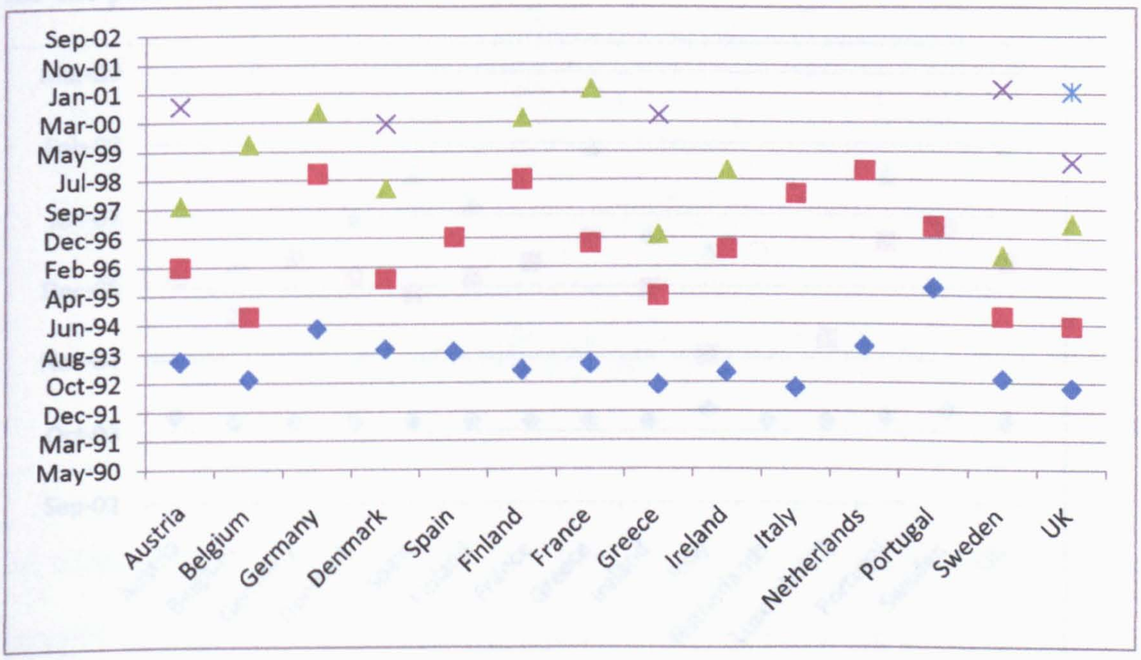
5.5 Structural break test results for the deposit and lending spreads to households

The Bai and Perron (1998) structural break tests have been conducted on deposit and lending spreads[18] using the Pierre Perron's[19] GAUSS program and have been conducted in OxEdit[20]. The Bai and Perron (1998) *UD*max and *WD*max and the $SupF_T(m+1|m)$ statistics are reported in Tables 5D.1 to 5D.11 of Appendix 5D. For all the deposit, lending and mortgage spreads series for the periods 1991-2008, the *UD*max and *WD*max indicate the presence of mean breaks. The $SupF_T(m+1|m)$ statistics suggest a selection of around 3-4 breaks for the deposit, consumer credit and mortgage rates for the period 1991/5-2002 and the selection of predominantly 2-3 breaks for the period

[17] See Centeno and Mello (1999), Sander and Kleimeier (2000, 2003) Schuler and Heinemann (2002a), amongst others. These studies also conduct time-series analysis.
[18] The spreads refer to the interest rate differentials between the deposit or lending rate and the corresponding weighted average rate.
[19] The GAUSS program code is available from Pierre Perron's home page at http://econ.bu.edu/perron/.
[20] The results are generated using Ox version 4.00 (see Doornik, 2005)

2003-2008. The specific break dates for each data series are listed in Appendix 5E. The break-dates for the EU countries for the first data series are charted below in Figure 5.2.

Figure 5.2 Structural break dates for the short term deposit spreads to households for the period 1991-2002[21]



The short-term deposit spread series reveal the presence of 3 breaks for five countries while the rest have either 2 or 4 breaks. As illustrated above in Figure 5.2, the first break for twelve[22] countries of the fourteen countries is visibly clustered around the period September 1992 up to November 1993. Three of these countries (Belgium, Sweden and UK) then have a second break between June and September 1994 while another four of these countries, namely, Austria, Spain, France and Ireland, have their second break between February to December 1996. The remaining countries mostly have a break between March and October 1998. The countries with more than 2 breaks have their final break between March and September 2000 or in February/March 2001.

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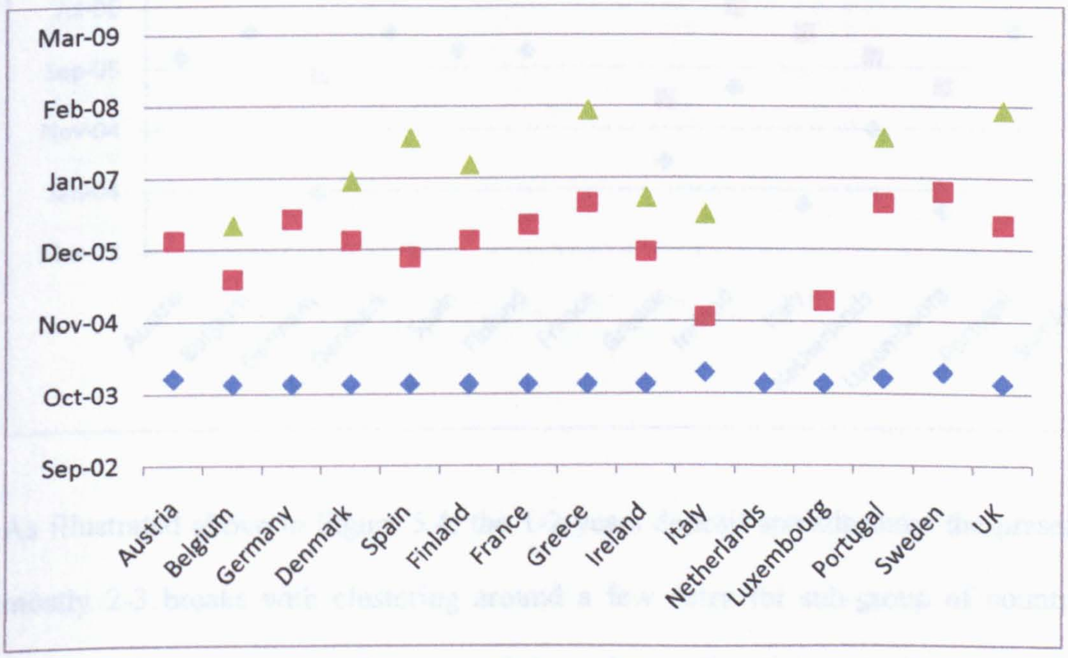
21 ◆ Denotes the first break; ■ denotes the second break; ▲ denotes the third break, and × denotes the fourth break. ✳ denotes the fifth break.

22 AT, BE, DK, ES, FI, FR, GR, IE, IT, NL, SE, UK

Overall, it can be observed that the concentration of breaks around specific dates is visible while, at the same time, the composition of the sub-group of countries experiencing these breaks is also quite consistent throughout.

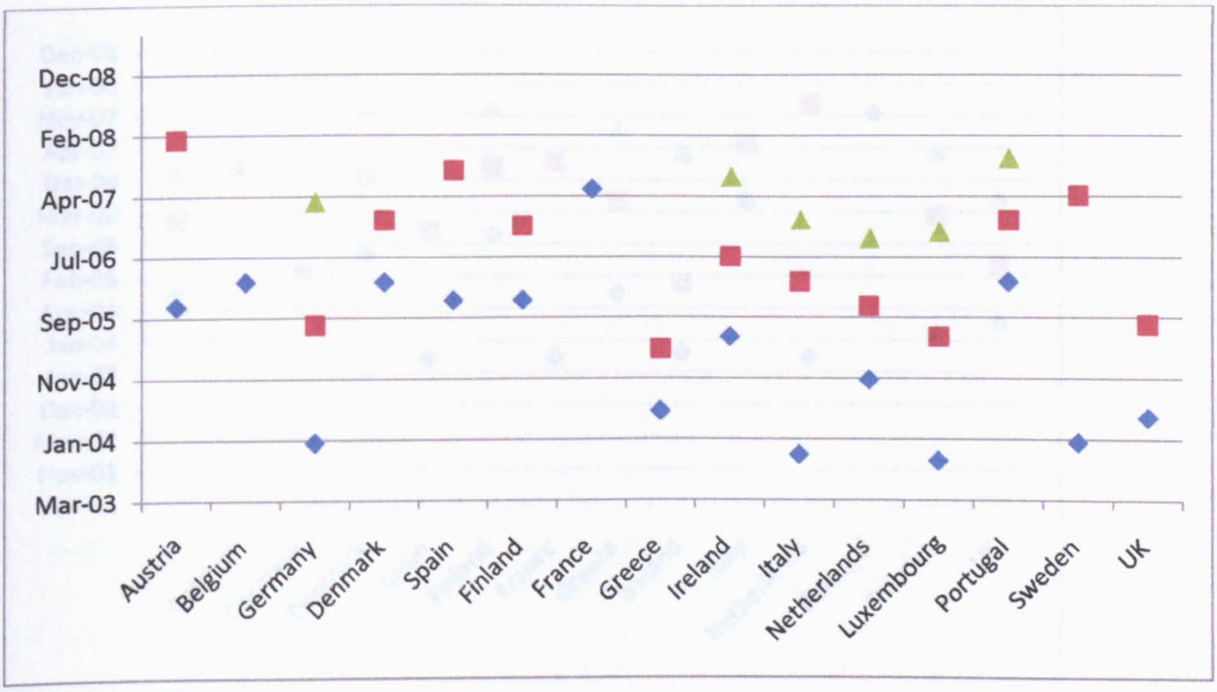
Figure 5.3 Structural break dates for the 1 year deposit spreads to households for the period 2003-2008[23]



With regards to the short-term deposit spreads for the period 2003-2008, as illustrated in Figure 5.3 above, the clustering of the breaks, especially for the first one, is very pronounced. Indeed, eleven of the countries have a first break in December 2003 while the remaining four have their break in January/February 2004. Subsequently, four of these countries (Belgium, Spain, Ireland, Luxembourg) have a second break between March to December 2005 while ten[24] countries have a break February and November 2006.

[23] Denotes the first break; denotes the second break; and denotes the third break.
[24] AT, DE, DK, FI, FR, GR, IT, PT, SE, UK.

Figure 5.4 Structural break dates for the 1-2 years deposit spreads to households for the period 2003-2008[25]

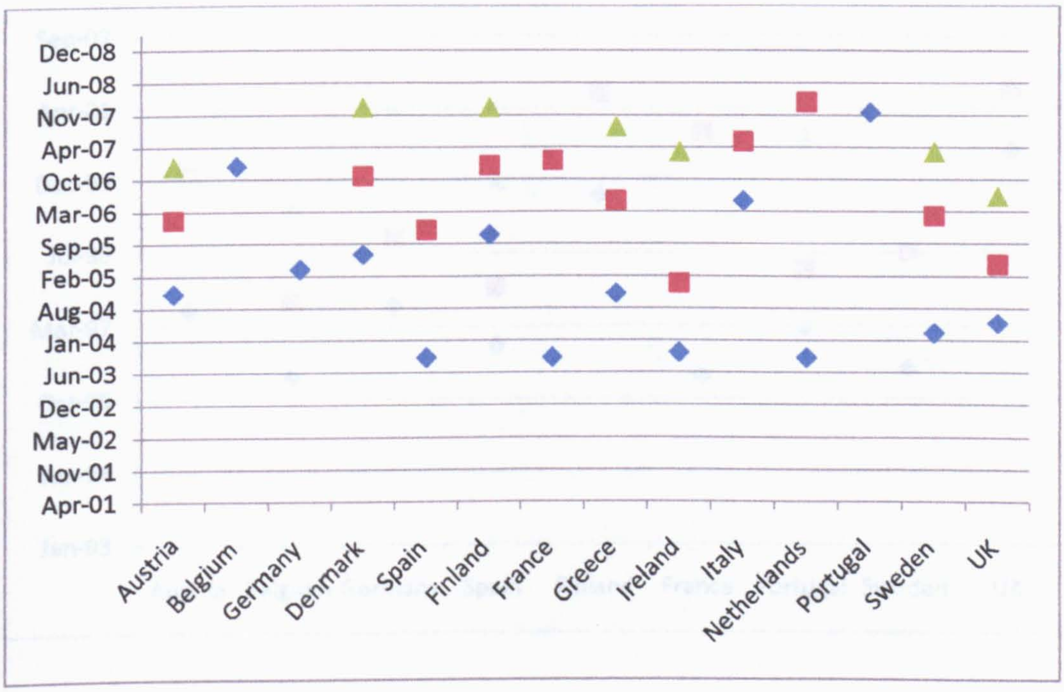


As illustrated above in Figure 5.4, the 1-2 years deposit spreads show the presence of mostly 2-3 breaks with clustering around a few dates for sub-group of countries as opposed to group clustering around key dates. For instance, Germany, Greece, Netherlands, Sweden and UK have their first break around January and November 2004 while Austria, Belgium, Denmark, Spain, Finland, Ireland, and Portugal have a break around November/December 2005 or March 2006. Another noticeable break for seven[26] countries occurs around January to November 2007.

[25] Denotes the first break; denotes the second break; and denotes the third break.

[26] DE, DK, ES, IE, IT, PT, SE

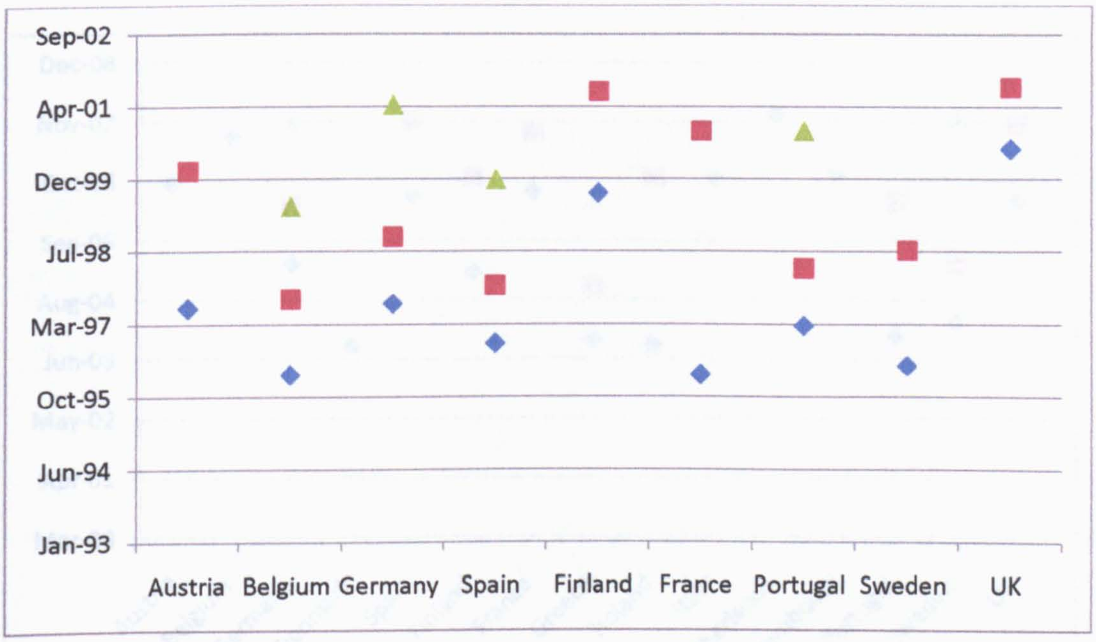
Figure 5.5 Structural break dates for the over 2 years deposit spreads to households for the period 2003-2008[27]



As for the deposit rates with over 2 years' maturity, seven of the countries have 3 breaks while four countries have 2 breaks and three countries have one break (see Figure 5.5 above). The first sign of clustering of the break dates is around October /November 2003 for Spain, France, Ireland and Netherlands while for Austria, Greece, Sweden and UK, the first break is in March/May or November 2004. The other obvious sign of clustering involves nine[28] countries with a common break occuring between January to September 2007.

[27] ◆ Denotes the first break; ■ denotes the second break; and ▲ denotes the third break.
[28] AT, BE, FI, FR, GR, IE, IT, PT, SE.

Figure 5.6 Structural breaks for the consumer credit spreads to households for the period 1995-2002[29]



The consumer credit spreads data series for the period 1995 to 2002 do not depict any pronounced clustering of the break dates, as illustrated above in Figure 5.6. Out of the nine countries in the sample, four countries have 3 breaks while 5 countries have two breaks. The first break for Belgium, Spain, France and Sweden occurs between April to November 1996 while for Austria, Belgium and Portugal, the first break occurs between March and July 1997. Three countries, namely, Germany, Portugal and Sweden have a second break around April to November 1998 while the final break for Austria, France and Portugal is in February/November 2000 and in May/August or September 2001 for Germany, Finland and the UK.

[29] ◆ Denotes the first break; ■ denotes the second break; and ▲ denotes the third break.

Figure 5.7 Structural breaks for the 1-year consumer credit spreads to households for the period 2003-2008[30]

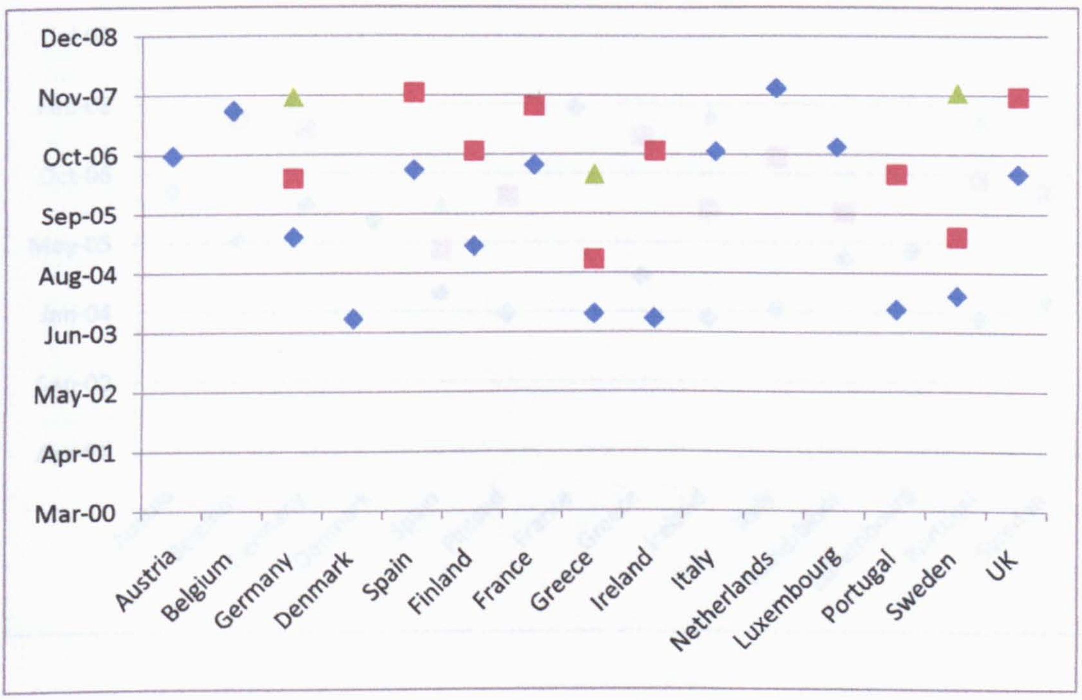


Figure 5.7 above illustrates the break dates for the short-term consumer credit spread data for the period 2003-2008 and it can be observed that most of the breaks tend to rally around 2006/7. However, four of the countries, namely Greece, Ireland, Portugal, and Sweden, have a first break between October to December 2003 or in March 2004. Subsequently, most of the countries (eleven[31] in total) have a break between May and December 2006. The other noticeable break occurs between August and December 2007 and is associated with the spread series for Belgium, Germany, Spain, France, Sweden and UK. Netherlands, on its part, has a break in January 2008. Overall, the clustering of the breaks around 2006/7 is similar to those observed for the deposit rates for the same period.

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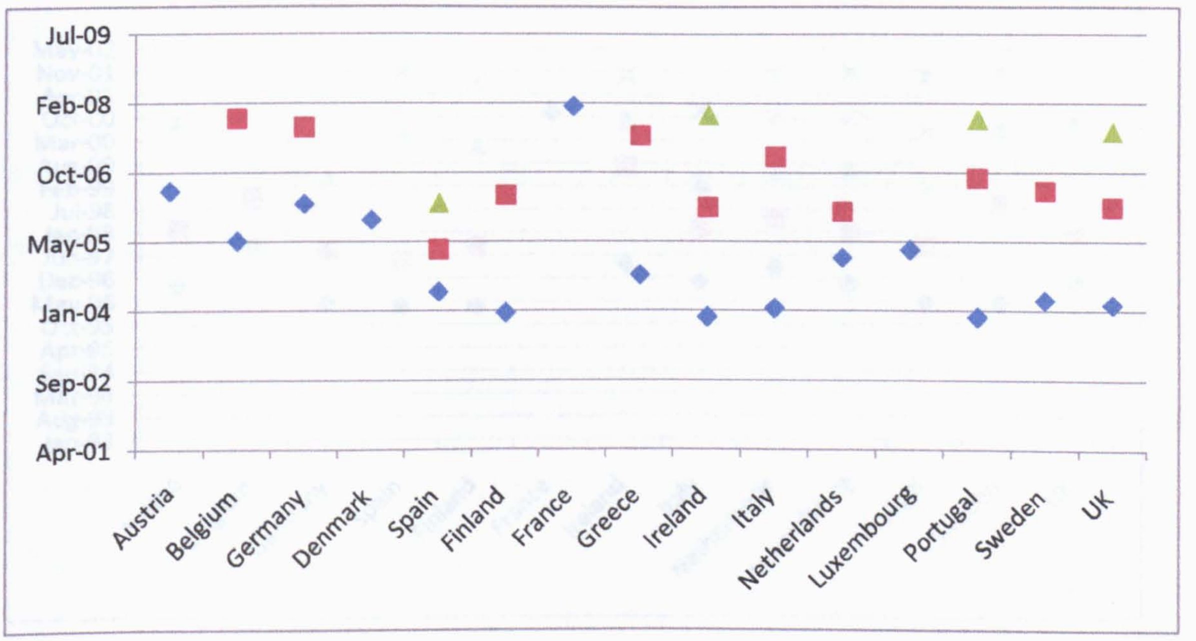
[30] ◆ Denotes the first break; ■ denotes the second break; and ▲ denotes the third break.
[31] AT, DE, DK, FI, FR, GR, IE, IT, LUX, PT, UK.

Figure 5.8 Structural breaks for the 1-5 years consumer credit spreads to households for the period 2003-2008[32]



Seven of the 15 EU countries in the sample for consumer credit spreads with longer maturities reveal the presence of 2 breaks while four countries have 3 breaks and another four have 1 break (see Figure 5.8 above). Six countries namely, Spain, Finland, Greece, Italy, Sweden and UK have a break between January to June 2004 while Belgium, Denmark, Netherlands and Luxembourg have their first break Between February and November 2005. In 2006, eight[33] of the 15 countries show a break between January and September 2006 but predominantly in the first half of the year. Then in 2007, seven[34] of the countries (four[35] of which had a previous break in 2006) have a break between February to December 2007, but predominantly in the later half of the year. Overall, the clustering of the breaks for this group of consumer credit spreads seems fairly consistent with the previous findings.

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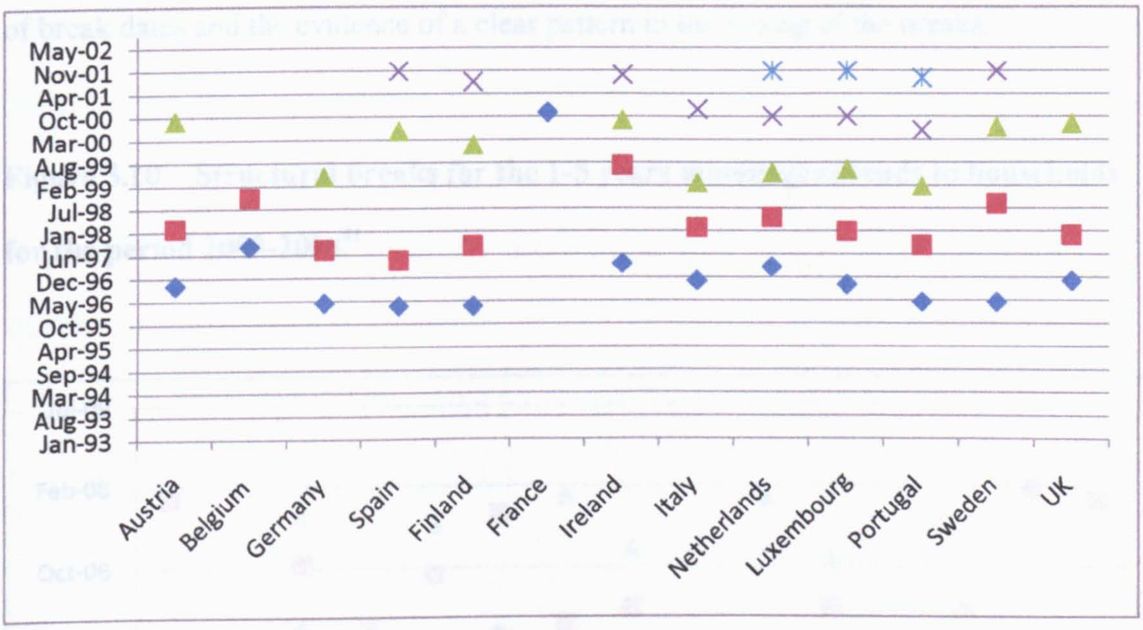
32 ◆ Denotes the first break; ■ denotes the second break; and ▲ denotes the third break.
33 AT, DE, ES, IE, NL, PT, SE, UK
34 BE, DE, GR, IE, IT, PT, UK
35 DE, IE, PT, UK

Figure 5.9 Structural breaks for the 2-5 years mortgage spreads to households for the period 1995-2002[36]

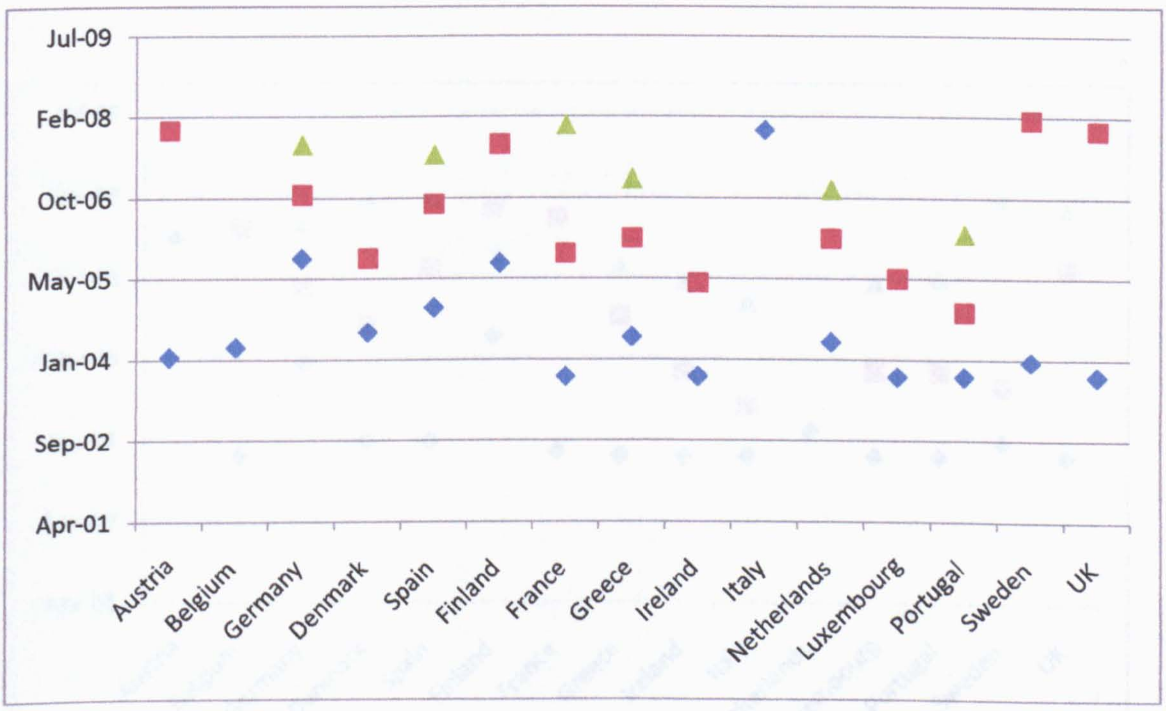


As seen in Figure 5.9 above, the break dates for the short-term mortgage spreads for the period 1995-2002 are closely clustered in the years 1996 to 1998, in 2000 and in 2001. In addition, this data set shows a high number of breaks with five countries with 4 breaks, three countries with five breaks, another three countries with 3 breaks and the remaining two countries with one and two breaks respectively. Nine[37] of the 13 countries have their first break between May and November 1996. Five of these countries namely, Germany, Spain, Finland, Portugal and UK plus Belgium, Ireland, and Netherlands have a break between April to December 1997. Six[38] countries then have a break between January to November 1998 (predominantly in February). Three of these countries namely Italy, Netherlands and Luxembourg plus Germany and Portugal

36 Denotes the first break; denotes the second break; denotes the third break, denotes the fourth break and denotes the fifth break.
37 AT, DE, ES, FI, IT, LUX, PT, SE, UK
38 AT, BE, IT, NL, LUX, SE

have another break March and May 1999. Subsequently, eleven[39] of the countries have a break between February to November 2000 while seven[40] of them have a break between August to November 2001. Overall, what are noticeable here are the high level of break dates and the evidence of a clear pattern in the timing of the breaks.

Figure 5.10 Structural breaks for the 1-5 years mortgage spreads to households for the period 2003-2008[41]

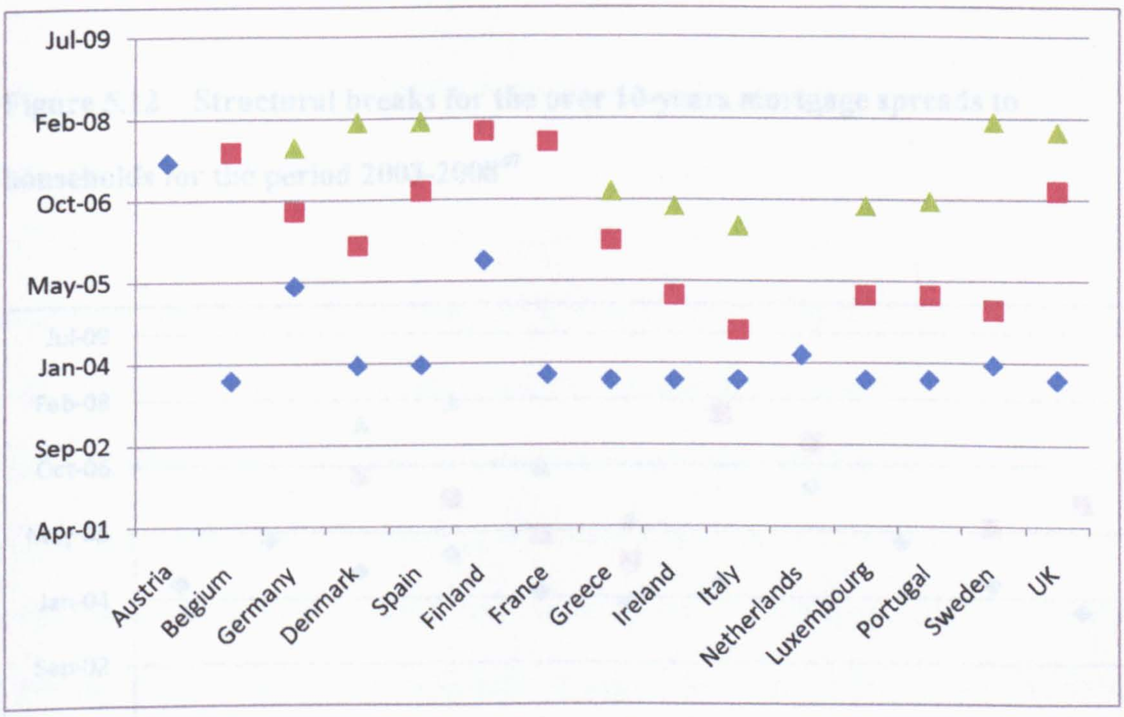


With regards to the mortgage spread series with 1-5 maturities, six countries show the presence of 3 breaks, while seven countries have 2 breaks and 2 countries have 1 break. As illustrated in Figure 5.10 above, most of the breaks tend to occur in 2003/4, 2006 and 2007 and are visibly clustered within the group of countries. Five countries, namely France, Ireland, Luxembourg, Portugal and UK have a specific break in October 2003

[39] AT, ES, FI, FR, IE, IT, NL, LUX, PT, SE, UK
[40] ES, FI, IE, NL, LUX, PT, SE
[41] ◆ Denotes the first break; ■ denotes the second break; ▲ denotes the third break.

while another seven[42] countries have their first break between January to June 2004. Most of the countries then have a break in 2006 and/or 2007. Five of them, namely Germany, Spain, Greece, Netherlands and Portugal have a break in February/March or September/November 2006. Then, in 2007, seven[43] of the countries have a break, mostly occurring in December.

Figure 5.11 Structural breaks for the 5-10 years mortgage spreads to households for the period 2003-2008[44]



The mortgage spread series with medium-term maturities mostly reveal the presence of 3 breaks, which is the case for 10 out of the 15 countries while the remaining five countries have either 2 or 1 break (see Figure 5.11 above). For eight[45] of the countries, similar to the mortgage series with 1-5 years maturities, the first break occurs in

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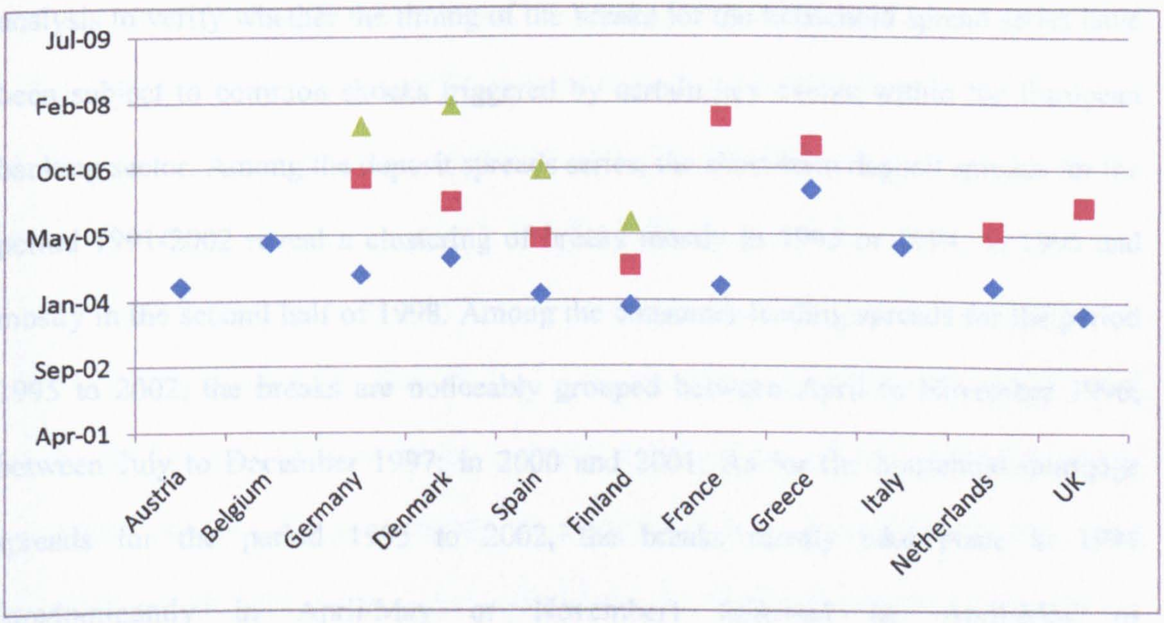
[42] AT, BE, DK, ES, GR, NL, SE
[43] AT, DE, ES, FI, GR, IT, UK
[44] ◆ Denotes the first break; ■ denotes the second break; ▲ denotes the third break.
[45] BE, FR, GR, IE, IT, LUX, PT, UK

October/November 2003. Four other countries, namely, Denmark, Spain, Netherlands and Sweden have their first break in January or March 2004. Another observation is the occurrence of a specific break in March or May 2005 for Germany, Ireland, Luxembourg and Portugal. Subsequently, nine[46] of the countries have a break. Denmark, Spain and Sweden, on their part, have their final break in February 2008. Overall, it can be observed that the timing of the break dates for this data set is very similar to that of the previous data set, whereby most of the initial breaks are clustered in 2003/4, 2006 and 2007. Moreover, the groupings of the countries in each cluster are also quite consistent across the two data sets.

Figure 5.12 Structural breaks for the over 10-years mortgage spreads to households for the period 2003-2008[47]



With regards to the mortgage rate with longer maturities, as illustrated above in Figure 5.12, most of the breaks occur in 2003/4 and 2006/7. Eight of the countries have a first

[46] DE, DK, ES, GR, IE, IT, NL, PT,UK

[47] Denotes the first break; denotes the second break; denotes the third break.

break in October/December 2003 or between March to December 2004 (mostly around May). In 2005, Belgium, Spain, Finland, Italy and Netherlands have a break between April and September while another four countries (Germany, Denmark, France and UK) have a break between January and August 2006. In 2007, only three countries namely Germany, France and Greece have a break. Overall, it can be observed that there is not any obvious pattern of clustering in the break dates for this data set except for the break that occur in 2003/4.

5.6 Analysis of patterns in break dates

Overall, it can be observed that the break dates for the spreads for the 3 categories of household rates, namely deposit, consumer lending and mortgages, for the period 1991 to 2008 are clustered around some specific months and years. The next step in the analysis to verify whether the timing of the breaks for the household spread series have been subject to common shocks triggered by certain key events within the European banking sector. Among the deposit spreads series, the short-term deposit spreads for the period 1991-2002 reveal a clustering of breaks mostly in 1993 or 1994; in 1996 and mostly in the second half of 1998. Among the consumer lending spreads for the period 1995 to 2002, the breaks are noticeably grouped between April to November 1996; between July to December 1997; in 2000 and 2001. As for the household mortgage spreads for the period 1995 to 2002, the breaks mostly take place in 1996 (predominantly in April/May or November) followed by April-May or September/December 1997; January/February or September/November 1998; April in the second half of 2000; and between August to November 2001. It can thus be observed that the household series in all three categories for the period 1991-2002 have experienced structural change in the same periods.

With regards to the first break that takes place in 1993 or 1994, the timing coincides with the establishment of the Single European Market and the removal of the barriers to the free movement of goods and services. Furthermore, at the same time, two key Directives for the banking sector, namely, the Capital Adequacy Directive of 1993 and the Deposit Guarantee Schemes Directive of 1994 were formally adopted. The Capital Adequacy Directive aims at establishing uniform capital requirements for banks and other investment and credit institutions by specifying the capital adequacy requirements, their calculation and the rules for their prudential supervision. The main objective of this Directive[48] was to enhance financial stability and integrity. The main objective of the Deposit Guarantee Schemes Directive[49] was to provide protection to all EU depositors and to consolidate the workings of the EU internal market by establishing a harmonised minimum deposit guarantee level of Eur 20,000. The Directive requires every credit institution to join a deposit guarantee scheme. The next break for all the series in all the three categories of household spreads occur mostly in 1996. The timing of this second break is quite significant as it matches the entry into force of the Investment Services Directive which was heralded as being a major catalyst to the completion of the single market in financial services. This Directive aimed at removing existing restrictions on the provision of cross-border financial services and to allow investment firms in Member States to freely trade on each others' exchanges. These measures would thus bring in greater competition and integration within the European financial services market and could be responsible for the structural change experienced by almost all of the household data series.

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[48] Refer to Chapter 3 for a detailed discussion of the Capital Adequacy Directive.
[49] Refer to Chapter 3 for a detailed discussion of the Deposit Guarantee Schemes Directive.

The next series of breaks take place in 1997 and mostly involves the consumer lending data series. Again, the timing of the break dates appears to match key events within the history of the European banking sector. For instance, in July 1997, the Commission adopted a Recommendation on electronic payment instructions which set out minimum transparency standards and customer redress requirements, amongst others and applies to card payments, home and phone-based applications, store cards and e-money. The main objective of this Recommendation was to develop consumer protection in the financial services industry and to boost confidence in electronic payments. Later, in 1997, the Commission made progress with regards to the simplification of the legislative framework in the banking sector under the Simpler Legislation for the Single Market (SLIM) initiative. The proposal put forward was to consolidate various banking Directives into a single "Banking Code" which would facilitate banking legislation. The household data spread series reveal a set of breaks throughout the whole of 1998 and mostly in May, which correspond to two major events. Firstly, in May 1998, the Directive on settlement finality in payment and securities settlement systems was adopted. This Directive aims at facilitating the existing cross-border payment and securities settlement systems and make them more cost effective and efficient by specifically covering collateral security. Secondly, in late 1998, the European Commission presented its Financial Services Action Plan (FSAP) which aims at improving the single market in financial services. With regards to the retail banking market, the proposals identified six main areas for progress, namely information and transparency, redress procedures, customer protection rules, electronic commerce, insurance intermediaries, and cross-border retail payments.

The 1991-2002 data series exhibit another set of breaks in 2000. These breaks coincide with the adoption of the Consolidated Banking Directive in March 2000, an important regulatory change in the EU banking sector. This codified Directive replaced and consolidated six existing banking Directives namely the First Banking Directive, the Own Funds Directive, the Second Banking Directive, the Banking Supervision Directive, the Solvency Ratio Directive and the Large Exposures Directive (refer to Chapter 3 for a detailed discussion of these directives). Amongst others, the key provisions of the Consolidated Directive relate to requirements for setting up credit institutions, capital requirements for operational and credit risk, and disclosure requirements. The data series in all 3 categories of household deposit and credit spreads also reveal the presence of breaks in the year 2001. Here it can be observed that these structural changes could be the result of the following events. Firstly, in March 2001, the European Council adopted the Directive on the winding up of credit institutions. This Directive sets outs the procedures to be followed in the event that a credit institution with branches fails. For instance, from then on, only the Bankruptcy laws of the home country would rule and thus uniform insolvency proceedings for all creditors could be guaranteed. Prior to this Directive, more than one jurisdiction could prevail and thus creditors could face unequal treatment. Hence, the adoption of this Directive was meant to bring greater and more consistent consumer and investor protection. Secondly, in March 2001, more specific to the mortgage market, a "voluntary code of conduct on pre-contractual information for home loans"[50] was launched by the European Commission.

Thirdly, in September 2001, political agreement was reached by the Council of ministers on the Distance Marketing of Financial Services Directive. This Directive is expected to further enhance consumer protection and harmonise the legal environment

[50] http://ec.europa.eu/internal_market/finservices-retail/docs/home-loans/agreement_en.pdf

for the business operators through the prohibition of abusive marketing practices, rules on consumers' right to withdrawn, etc.

As for the household deposit and credit data spread series for the period 2003-2008, it can be observed that with regards to the deposit rates with 1-year, 1-2 years and over 2 years maturities, the majority of the breaks take place between late 2003 and early 2004, between July to December 2005, throughout 2006 (predominantly in February) and in 2007. The data spread series on consumer credit with 1 year and 1-5 years maturities, show the occurrence of break dates around similar time periods, more specifically around late 2003 and early 2004, in the first half of 2005, in 2006 and in the second half of 2007. As for the mortgage spreads with 1-5 years, 5-10 years and over 10 years maturities, the presence of structural breaks are revealed in late 2003, in the first half of 2004, throughout 2006 and in the second half of 2007 or in early 2008. Just like with the break dates for the earlier period, similarly here, the break dates can be matched with key happenings in the European deposit and credit markets.

The first set of breaks for the credit rates are clustered in late 2003 and 2004 and the following events could be responsible for the shocks experienced by the consumer credit and mortgage series. Firstly, in November 2003, the European Commission decided to set up a European Banking Committee, responsible for the application of community legislation in Member States and ensuring convergence in supervisory practices, amongst other duties. Secondly, in April 2004, the European Parliament adopted a Directive on markets in financial instruments with the aim of regulating the activities of individuals and businesses that provide a range of financial services to investors across the EU. A set of comprehensive measures on matters such as investment activities, organisational requirements for investment firms, and transparency requirements for share transactions, formed the basis of this directive. Thirdly, in December 2004, the expert forum group on mortgage credit which was set up in 2003 to provide advise on how to further the integration of the EU mortgage market, published its report. The recommendations put forward consist of both legislative and non-legislative measures covering areas such as consumer protection, mortgage brokers, cross-border contracts, collateral issues, financing of mortgages and others. With regards to the deposit data spread series, a common break is reported mostly in the second half of 2005 and this coincides with a review conducted by the Commission in November 2005 on the €20,000 minimum guaranteed level under the EU deposit guarantee scheme, and whether it should be revised.

Interestingly, all the deposit and credit spreads data unanimously show the occurrences of breaks throughout the year 2006 (predominantly in the first half of the year), and in 2007. A review of the major events that took place in the European banking sector in these two years points to some key developments that seem very likely to have caused the structural breaks. Firstly, in June 2006, an amended Capital Requirement Directive for banks and investment firms was formally adopted by the European Council and Parliament. This Directive updates the supervisory framework in the EU and also reflects the Basel II rules on capital standards agreed upon at the G-10 level (refer to Chapter 3 for more information). Secondly, in the first half of 2006, substantial progress was also achieved with regards to the implementation of the Single Euro Payments Area (SEPA), with the deployment phase on direct debit instruments and cards framework well under-way. The SEPA[51] initiative is highly significant for the European banking sector, as it would remove the existing legal and technical barriers for cross-border payments. Thirdly, another event in 2006 which may have had a role to play in the

[51] See Chapter 3 for a detailed discussion.

happening of the breaks is the adoption by the European Council and Parliament of the Services Directive, also known as the Bolkestein Directive. This directive is a major issue for the European Union as it seeks to eliminate the barriers in services across the EU and complete the single market. The triggers behind the structural breaks in the year 2007 are very likely to have been new developments in the mortgage and consumer credit markets and in the EU cross-border payments area. For instance, in January 2007, the European Commission published two strategic reports on mortgage funding and consumer protection, which were prepared by two expert groups set up in April 2006. The report from the Mortgage Funding Expert Group reviews existing barriers to an efficient mortgage funding market and sets out detailed proposals to remove these obstacles. The mortgage industry and consumer report, on its part, looked at four essential consumer issues, namely pre-contractual information, advice, early repayment and the annual percentage rate (APR) charge. The conclusions drawn from these reports have subsequently been incorporated in the Commission's White Paper on the Integration of EU Mortgage Credit Markets which was adopted in December 2007.

In addition, in May 2007, the European Commission also presented a Green Paper on retail financial services in the single market which seeks to further strengthen consumer protection and regulation of service providers. Consultations on this Green Paper took place later in September 2007 and the conclusions were later incorporated in the review of the single market, entitled "A single market for 21st century Europe"[52] in November 2007. Furthermore, again in May 2007, political agreement was reached on the amended Consumer credit Directive which seeks to harmonise credit rules while also covering a broader range of credit instruments. This Directive is crucial for the workings of a single market for consumer credit (refer to Chapter 3 for a detailed

[52] http://ec.europa.eu/internal_market/strategy/index_en.htm

discussion). Another key development in December 2007 is the adoption of the Payment Services Directive[53] which seeks to harmonise the rules on payment services and provide a uniform platform for effective and competitive cross-border payments to payment service providers via the use of SEPA.

5.7 Panel unit root test: IPS (2003) test results

The IPS panel methodology is used to test for stationarity in the spread data which is the interest rate differential between each individual country's deposit or lending rate and the corresponding European weighted average rate. The argument being that the presence of stationarity would indicate convergence. The Im, Pesaran and Shin (2003) panel unit root test is run on two sets of panels for each data category. Firstly, the panel unit root tests are run on the original spread panels and secondly the test is run on the demeaned spread panels. The test is performed on demeaned spread data in order to remove the effects of structural breaks. The results obtained for both the deposit and lending spreads and demeaned spreads are reported in Appendix 5F. There is a sharp contrast between the results obtained for the original spread data compared to those for the demeaned spread data sets for all the three retail instruments, namely deposit rates, consumer lending rates and mortgage rates. With regards to the short-term deposit rates to households for the period 1991-2002, the null hypothesis of a unit root is rejected for both the level and demeaned spreads panel data sets. However the rejection is must stronger (at 1% significance level) for the demeaned spreads. As for the remaining 3 categories of deposit rates for the 2003-2008 period (1-year, 1-2 years, >2 years maturities), the null hypothesis of a unit root cannot be rejected in all three instances when level data is tested. However, the results for the 3 demeaned spreads panels are

[53] See Chapter 3 for more information.

completely different with the presence of stationarity strongly detected at 1% and 5% significance level.

As for the consumer credit rates, the null hypothesis of a unit root cannot be rejected for all 3 panel data sets (level spreads), namely, consumer loans for the period 1995-2002, consumer loans with 1 year maturity for the period 2003-2008 and consumer loans with 1-5 years maturities for the period 2003-2008. However, when the IPS test is run on the demeaned spreads for the same instruments, the results differ markedly. The null of a unit root is strongly rejected (even at 1% significance level) for all 3 categories of consumer credit rates for both the 1990s and the more recent period. A similar picture emerges when the mortgage rates to households are tested for stationary in their differences. The null of a unit root cannot be rejected for all the 4 panel data sets (level spreads), namely, mortgage rate with 2-5 years maturities for the period 1995-2002; the panel data set with 1-5 years maturity duration for the period 2003-2008; the mortgage rates with 5-10 years maturities for the period 2003-2008; and the mortgage data with over 10 years maturities for the period 2003-2008. In the same vein as with the results obtained on demeaned spreads for the deposit and consumer credit rates, the null of a unit root is strongly rejected (at 1% significance level) for all four demeaned panel mortgage spreads.

The results obtain allow the following observations to be formulated. Firstly, the need to account for structural breaks is crucial, as highlighted by the completely opposite results obtained depending on whether level spreads or demeaned spreads are tested. Given the evidence discussed in Chapter 4 on the importance of accounting for structural breaks, all conclusions drawn in this section will be based on findings obtained from the tests on the demeaned spreads. Secondly, the more robust panel data analysis indicates that convergence in the retail banking market is evident in the deposit, consumer credit and mortgage sectors within the European Union. Significantly, the results suggest that this convergence process started well in the 1990s, most probably spurred on by the major initiatives that were rolled out at the time by the European Commission such as the Banking and Consumer Credit Directives, amongst others.

5.8 Pesaran's Cross Dependence test results

The Pesaran (2004) cross-dependence diagnostic test is applied to all the panel data sets before running the Pesaran (2007) CIPS test. The results are tabulated in Appendix 5G, Table 5G.1. The CD test statistics show that there is indeed cross-dependence between the series for most of the level and demeaned panel spreads for the deposit rates to households; consumer credit rates and residential mortgage rates for the period 1991-2008. The overwhelming presence of cross-section correlation clearly justifies the need of using the CIPS panel unit root test.

5.9 Panel unit root test: Pesaran's (2007) CIPS test results

In the same vein as with the IPS tests, the CIPS test is applied to both level and demeaned spreads data for the deposit, consumer credit and mortgage panels. The results for the CIPS test for the panel of both level and demeaned spreads are shown in Appendix 5G, Table 5G.2. The statistics are based on an autoregressive process including an intercept term only.

With regards to the deposit spreads to the household sector for the period 1992-2002, the null hypothesis of a unit root cannot be rejected for the level panel data sets.

However, in sharp contrast, when the CIPS test is run on the demeaned spreads for the same period, the null of a unit root is rejected at 1% significance level. As for the 2003-2008 1-year deposit rate panel with level spreads, the null of a unit root cannot be rejected. However, it is rejected for the demeaned spreads panel (10% significance level). As for the 2003-2008 deposit rates with maturities between 1-2 years, the null hypothesis of a unit root cannot be rejected for the level panel data sets. However, in sharp contrast, when the CIPS test is run on the demeaned spreads for the same period and maturities, the null of a unit root is rejected, (1% significance level). As for the deposit with over 2 years maturities for the 2003-2008 period, the null of a unit root is strongly rejected (1% level) when both level and demeaned data are tested.

For the consumer credit rates for the period 1995-2002 and 2003-2008 with maturities ranging from up to 1 year and between 1-5 years, the null of a unit root cannot be rejected in all 3 instances when level spreads panel data is tested. However, when the demeaned consumer credit spreads are tested, the null of a unit root is strongly rejected (1% level) for all the data sets.

A similar picture emerges for the mortgage panel sets whereby the null of a unit root cannot be rejected when the following original spread data are tested; the 1995-2002 (2-5 years) mortgage panel set and the 2003-2008 (1-5 years; 5-10 years & over 10 years) mortgage panel data sets. Strikingly, when the demeaned spreads of these mortgage categories are tested, the null of a unit root is strongly rejected (even at 1% significance level) in all 4 instances.

Based on the CIPS test results for the deposit and lending rates, two major observations can be put forward. Firstly, the contrasting results obtained for the level and demeaned spread data sets once more highlight the importance of accounting for structural breaks. These findings are in line with the IPS test results discussed in Section 5.7. Secondly, the presence of stationarity in the deposit, consumer credit and mortgage rates for the period 1991/5-2002 suggest that convergence was present in the retail banking sector right from the 1990s. The results for the 2003-2008 data sets point to a continuation in the integration process in the European retail banking sector.

5.10 Phillips and Sul (2007) panel convergence tests

5.10.1 Phillips and Sul (2007) log *t*-test

So far, the time series cointegration test results and the panel unit root test results have provided information on whether any convergence can be detected in the retail banking sector. The next methodological procedure is one step up as the Phillips and Sul (2007) tests do not only detect the degree of convergence but also provide information on the speed of convergence for each individual country and investigates whether any sub-club formation has taken place.

Phillips and Sul (2007) recommend conducting the convergence log *t*-test on filtered data series in order to remove the cycle component of each series. The Hodrick-Prescott (1997) filter is thus employed for this purpose. As a result, the filtering process does away with the need to test for convergence among the demeaned data sets. The t-statistics obtained for the convergence test for the 4 categories of deposit rates; the 3 categories of consumer credit rates; and the 4 types of mortgage rates ranging from the period 1991/5-2002 and 2003-2008 are tabulated in Table 5H.1, Appendix 5H. Of noteworthy importance is the fact that the magnitude of the convergence coefficient, $\hat{b}$, provides key information on the rate of convergence. Basically, the higher the value of $\hat{b}$ the faster the rate of convergence.

5.10.1.1 Phillips and Sul (2007) log *t*-test for deposit rates

With regards to the short-term deposit rates for the period 1991-2002, the null of convergence cannot be rejected. As for the household deposit rate series with up to 1 year; 1-2years; and > over 2years maturities for the period 2003-2008, the null of convergence cannot be rejected as well. These results point to strong convergence in the European Union retail deposit market since the 1990s. Furthermore, based on the value of the convergence coefficient, the rate of convergence is highest for the deposit rates with the short-term maturities ($\hat{b}$ = 1.607) for the 2003-2008 period while the slowest rate of convergence is noted for the deposit rates with the highest maturity duration ($\hat{b}$ = 0.102) for the same period. On the whole, these results are in line with the ones from the panel unit root tests analysis but not so much with the cointegration analysis whereby the results indicate limited convergence.

5.10.1.2 Phillips and Sul (2007) log *t*-test for consumer credit

Regarding the 3 panel data sets for the consumer credit rates for the period 1995-2002, and 2003-2008, the log t-test rejects the null of convergence for all 3 categories of consumer loans. These results suggest that group convergence was not present in the household consumer credit market in the 1990s and throughout the years 2000. This is not surprising results given the highly segmented consumer credit market at the time due to differences in national legislations, credit reporting systems, lack of cross-border credit transfers, and varied importance of consumer credit across the Member States.

With regards to legislations, the Consumer Credit Directive was adopted in 1987 but was based on the principle of minimum harmonisation which resulted in Member States establishing different national legislation which in turn, became obstacles to the provision of pan-European products (European Commission, 2005a). For example, as reported by Lannoo and Munoz (2004), in Belgium, according to the Consumer Credit Act, consumers have to sign any credit agreement and include a handwritten note below their signature. In France, similarly, according to the French code de la Consommation, a handwritten declaration has to be provided, otherwise the credit agreement and guarantee is rendered void. In Germany, according to the German Civil Code, in the event of delays in repayments, lenders must give borrowers a two-week suspension period before cancelling the contract.

Another stark example of the differences in national legislations is the treatment of bankruptcy cases. For example, in France and Germany, personal bankruptcy is treated within the national bankruptcy regulations while in other Member States such as Spain, a customer cannot declare as bankrupt (Lanoo and Munoz, 2004). To counteract these differences, in 2002, the European Commission published proposals for a revised Consumer Credit Directive. However the proposals attracted major criticisms from all parties and it is only in 2007, that political agreement was finally reached on the harmonisation of credit rules and administrative tasks for Member States and the Directive was adopted in April 2008.

Moreover, the credit reporting systems across the EU is quite diverse. Three main types of credit reporting systems have been identified by the Expert Group on Credit Histories in the Member States, namely, private systems, public systems and dual systems (combination of public and private systems) (European Commission, 2009c). For instance, in Denmark, Finland, Greece, Ireland, Netherlands, Sweden and UK, a private credit reporting system is in place while Belgium and France have a public system. Countries such as Austria, Germany, Italy, Portugal, and Spain operate a dual system and Luxembourg has neither a public nor a private system. Hence, the limited integration in the consumer credit market detected for the 1990s period and for the more recent period can also be due to the diversity in credit reporting systems that co-exist in Europe.

Additionally, cross-border data information sharing through credit registers is limited within the EU and this obviously limits the opportunities for both providers of credit and potential customers. During the 1990s, sharing of cross-border credit data was even more limited and initiatives to facilitate cross-border data exchanges were rolled out in the years 2000s mostly. For instance, in 2005, based on a Memorandum of Understanding which was signed by 7 European central banks in 2003, data sharing among their public credit registers was underway. Some other countries such as Austria, Belgium, Germany, Italy and Sweden have set up bilateral agreements on credit-data sharing, although the number of reported inquiries between the Member States' credit registers is reported to be low (European Commission, 2009c). This is not surprising given that generally the public and private registers in Member States have in place a set of criteria which often act as a barrier to further integration and hamper competition. For example, it is explicitly cited in the credit registers of Austria, Spain and Portugal that physical presence is required for accessing the registers (European Commission, 2007b). Moreover the fee structure and levels charged by public and private registers tend to vary greatly among Member States. The survey conducted by the European Commission (2007b) revealed that fees can range from zero joining fees (typically for public registers) to up to Eur 75,000 for private credit registers. So in general, it has been observed that the market for credit data is largely fragmented within the EU and that cross-border data sharing is also limited. Changes have only recently been introduced through the Consumer Credit Directive of 2008 which aims to promote full access to credit databases between Member States. The revised Consumer Credit Directive had to be transposed by June 2010.

Additionally, in the 1990s, the system for cross border payments was largely fragmented and posed a major impediment to the integration of the consumer credit market. In 1999, the common large-value payment system, TARGET, was launched but for retail low-value payments, a large number of diverse payment systems are still in existence. The SEPA initiative which was designed in 2004 is currently going through its migration phase, which started in 2009, whereby national payment schemes will coexist with SEPA schemes. Thereafter, by the end of 2010, only SEPA instruments will be available (ECB, 2009a). The facilitation of cross-border Euro payments should put these transactions at par with national payments and potentially benefit the consumer credit markets which require regular monthly payments.

Another factor that can explain the limited convergence in the consumer credit market is the heterogeneous nature of the European consumer credit markets, where the importance of consumer credit varies substantially among the Member States. For instance in the UK, consumer credit, as a share of GDP, represented was around 14% in late 1990s while for Austria and Germany, for the same period, it was around 12%. In sharp contrast, for some other EU countries such as Belgium, Finland, Italy, Luxembourg and Netherlands, consumer credit was well below 6% (Lannoo and Munoz, 2004). This can be largely attributed to cultural differences and attitudes to credit within the EU.

Therefore, given the obstacles that prevailed in the 1990s in the consumer credit market, it is not surprising that cross-border consumer lending was limited. Lannoo and Munoz (2004) report that cross-border consumer lending in the EU was between 2-5% in 2002. The other channel through which other Member States' credit market can be accessed is through the establishment of branches or through mergers and acquisitions. However, there has been limited development in this area. As reported by Vennet (2002), in the 1990s and up to 2002, bank merger activity within the EU was sparse due to the presence of various barriers to entry. Additionally, based on calculations from OECD data (OECD, 2010), it can be observed that during the late 1990s and early 2000, the proportion of foreign-owned commercial banks stood at around 33% for Belgium, France, Netherlands and Spain while it was even lower, at around 20% for Italy.

The second observation that can be made on the log t- test results is that, for the more recent period, 2003-2008, the consumer credit rates with short-term maturities (1-year) and medium term maturities (1-5years) also show little evidence of convergence. These results are in line with those of Vajanne (2007) who investigates the convergence of consumer credit rates in the Euro-area during a similar time period by estimating β-convergence in interest rate spreads. Vajanne (2007) found that the spreads for the consumer credit rates with short maturities in the euro-area are still relatively large and attribute it to the product diversity that exist in this category.

Another explanation regarding limited convergence for short-term borrowing needs, is that the differences that exist among the credit markets in the EU such as language and cultural differences, the importance of proximity and local presence may prevail over any cost savings if alternative foreign lenders are considered, given the time period and amount of loan. Indeed, short-term loans represent a small proportion of total loans in general for the 15 EU countries. Therefore the credit market for such types of consumer loans is generally characterised by small volumes[54] and is thus not deep enough to warrant fierce competition. Hence, the institutional differences and product diversity that exist may be responsible for the absence of panel convergence, as evidenced by the log *t*-test results.

5.10.1.3 Phillips and Sul (2007) log *t*-test for mortgage rates

Regarding the mortgage rates, convergence is detected for both the 1995-2002 and 2003-2008 periods, except for one panel data set; the 2003-2008 mortgage rates with over 10 years maturity. In addition, the magnitude of the convergence is faster for the short-term mortgages rates ($\hat{b}$ =0.521) and lower for the medium term mortgage rates (($\hat{b}$ =0.389) and negative for the mortgage rates with longer term maturities (($\hat{b}$ =-0.099). On the whole, the log t-test results indicate that the European residential mortgage market is integrated since the 1990s but that no convergence is present for mortgage rates with long-term maturities.

These results are comparable to those of Vajanne (2007) and Sorensen Lichtenberger (2007), the only other two known studies that have specifically analysed the integration process of mortgage rates with various maturities. Vajanne (2007)[55] opines that the housing market in the euro area is more integrated especially with respect to mortgage rates with variable or short-term fixation compared to rates with longer fixations. In their study on the cross-country differences in euro-area mortgage rates for the period

[54] Based on OECD data on loans to households from individual Member State (OECD, 2010)
[55] The period covered is 2003-2006.

2003 to 2006, Sorensen and Lichtenberger (2007) estimate[56] that differences in maturity structure have a negative influence on mortgage rates with 5-10 years and over 10 years maturities. Moreover, their results also show that maturity structure is not significant for mortgage rates with short-term maturities. Hence, according to their estimates, mortgage rates with the 5-10 years and over 10 years maturities would be expected to have higher borrowing costs and can account for the heterogeneity in mortgage rates with longer-term maturities.

The log *t*-test results obtained for the mortgage rates with longer maturities can also be explained through economic theories on term structure of interest rates, such as the expectations theory and the liquidity preference theory. According to the expectations theory, long-term interest rates are determined by market expectations about the trajectory of future short-term interest rates and inflation rates. Hence, an upward sloping yield curve, for example, would imply that the market expects short-term interest rates to rise (Pilbeam, 2010). Within the context of European mortgage interest rates, Bondt et al (2005) show that long term retail bank interest rates adjust not only to short-term interest rates but also to long term market interest rates. This analysis is based on an error correction model that looks at long term mortgage rates in ten[57] EU countries. The authors argue that in the presence of uncertainty with regards to future monetary policy changes, banks adjust their long-term retail interest rates in line with a target long-term money market rate which would better incorporate any expected future changes. Their argument also proposes that interest rate exposure due to a mismatch in maturities for assets and liabilities will thus be limited.

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[56] This study works out pair-wise tests of coefficient equality with a set of control variables which are grouped under demand and supply-side determinants. One of the control variables tested, based on ordinary least square equations, is the maturity structure of mortgage instruments.
[57] AT, BE, DE, ES, FI, FR, GR, IE, IT, LUX, NL, PT

Furthermore, the conclusion that can be conjectured from this analysis is that if the pricing of long term retail banking products depends on long term market rates which incorporate sovereign risk, then diversity among the mortgage rates of individual member states will exist. Also, banks are likely to price their long term retail products based on individual bank's perception and management of interest rate risk and therefore, the more diverse the pricing behaviour of banks, the less integrated the retail market is bound to be.

The second theoretical explanation for the limited convergence in long-term mortgage rates is the liquidity preference theory whereby longer term interest rates not only reflect market expectations but also include a risk or liquidity premium to factor in the higher level of risk for the lender. Martin-Oliver et al (2007) investigate the retail banking rate differences among Spanish banks for the period 1989 to 2003 using the relative and absolute law of one price and find that credit risk premium which is part of the marginal costs of loans is an important explanatory factor for dispersion among loan rates for various banks. Furthermore, based on an analysis of variance (ANOVA) test, the study finds that loan maturity is an important determinant of interest rate variability. Overall, based on their findings, the authors extrapolate that differences in credit risk policies would have a significant bearing on European retail banking integration. A similar conclusion was also reported in the ECB (2006) report which compares the differences between the yield curve for different instruments of varying maturities and the euro area yield curve in order to measure the impact of the maturity duration. The findings show that the period of maturity does indeed have an impact on the mortgage rates to households. Hence the underlying implication is that the duration of interest rate maturity may very well influence the lending rate by reflecting credit risk. This would, in turn, explain cross-country differentials.

Furthermore, the importance and impact of liquidity and credit risks were highlighted with the recent financial turmoil that started in the summer of 2007. It would be expected to see a stronger impact of the crisis on transaction volumes and spreads for instruments with longer maturities. The ECB (2009b) report indicate that this was indeed the case for the euro area money market where the increase in perceived liquidity and credit risk led to depressed transaction volumes for longer term instruments, an increase in spreads for unsecured loans and a sharp increase in volatility. Banks responded by decreasing their credit lines and cutting back on their volume of loans. Furthermore given the exposure of several European tier-one banks such as Citigroup, HSBC, Credit Agricole, Deutsche Bank, and Commerzbank, the impact on the residential mortgage market in the EU has been severe as evidenced by a sharp fall in gross lending.

Based on the above findings, it can be conjectured that the impact of the financial crisis on the retail banking integration process is likely to be detrimental from both supply and demand-side factors. On the supply side, the mortgage market could take a more domestic-centred approach whereby factors such as the credibility of a government's macroeconomic policies; the regulatory responses and tightening measures; the rate of economic growth; the mix between fiscal and monetary policies; the reluctance of banks to extend their products across borders due to the funding crisis; and the supply of loanable funds; would play a bigger role. On the demand side, given the high-profile failures of certain credit institutions such as the Icelandic banks, customers are more likely to deal with domestic banks as opposed to foreign ones.

Overall, the Phillips and Sul (2007) convergence methodology suggest that the retail banking market for the household deposit and mortgage market are converging while the consumer credit market is not. Furthermore, integration is stronger for instruments with shorter maturities as compared with longer maturities instruments. In general, the Phillips and Sul (2007) log *t*-test results contrast with the results obtained under the cointegration analysis but can be partly reconciled with the weak cointegration results observed for the consumer credit market and especially with the mortgage series with the longest maturities whereby none of the countries in the series reveal any cointegration equations. The Phillips and Sul log *t*-test results also provide some contrasting results to the panel unit root test results on the demeaned spreads, especially for the consumer credit rates and the mortgage rates with over 10 years maturity. However, as argued by Phillips and Sul (2007), the absence of panel convergence under the log *t*-test may not necessarily rule out sub-group convergence whereby groups of countries within the sample have similar convergence paths. Hence, retail integration should not be ruled out just on the basis of the log t-test but must be analysed together with the club clustering test results which are discussed in the next section.

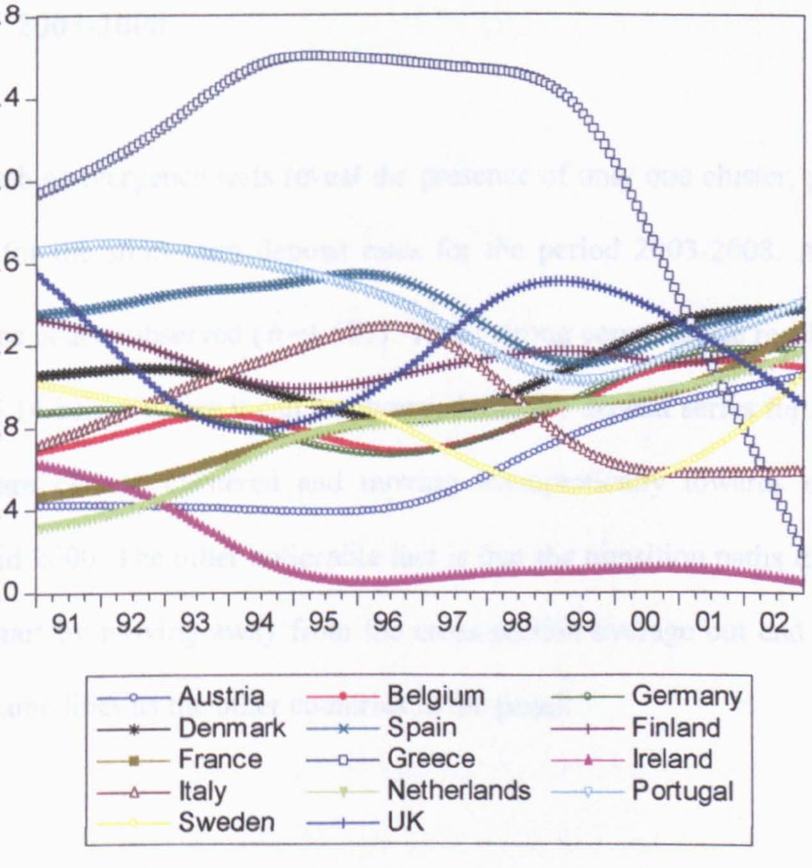
5.10.2 Phillips and Sul (2007) club clustering test and transition paths

Having established the presence of convergence in all of the deposit sets and most of the mortgage sets but none in the consumer credit panel sets, the next step in the analysis is the application of the Phillips and Sul (2007) clustering algorithm test which would identify countries that are converging together or diverging. The strength of this test is that even if the whole panel of 15 countries do not converge as a block, sub-group convergence, if present, may still be detected. The test statistics are reported in Table 5H.2, Appendix 5H and discussed below together with the third component of the test which is the calculation of each country's filtered relation transition coefficient, $\hat{h}_{it}$. This transition coefficient illustrates the path taken by each country's filtered series vis-à-vis the panel average over the time period investigated. Consequently, this procedure provides additional information on the convergence process in the European retail banking.

5.10.2.1 Panel results for the short term deposit rates for the period 1991-2002

As discussed in Section 5.10.1.1 above, the panel of 14 EU countries converge as a group for the short-term deposit rates for the 1991-2002 period. The clustering test reveals that the series for most of these countries belong to the same club. Two sub-groups have been identified; the first club groups Austria, Belgium, Germany, Denmark, Portugal, Spain, France, Finland, Sweden, Greece, Netherlands, UK while a second club includes Ireland and Italy. Regarding the speed of convergence, it is observed that a much faster rate of convergence is detected for the first club ($\hat{b}$=1.509) compared to the second club[58] which actually show a negative rate of growth ($\hat{b}$=-0.017). On the whole, combined with the log t-test results, the club clustering results indicate that strong convergence is detected for these deposit rates. As for the filtered transition coefficients $\hat{h}_{it}$ of each individual country's deposit series, as shown below in Figure 5.13, some interesting observations can be made.

Figure 5.13 Transition paths for each country's short-term deposit rate



As illustrated in Figure 5.13 above, at the start of the period, most of the countries' time paths start either well above or below the cross section average. However, by the late 1990s, a distinct clustering of the transition paths can be noticed. Some countries such as Greece, Ireland, Netherlands, Spain and Portugal actually show some erratic

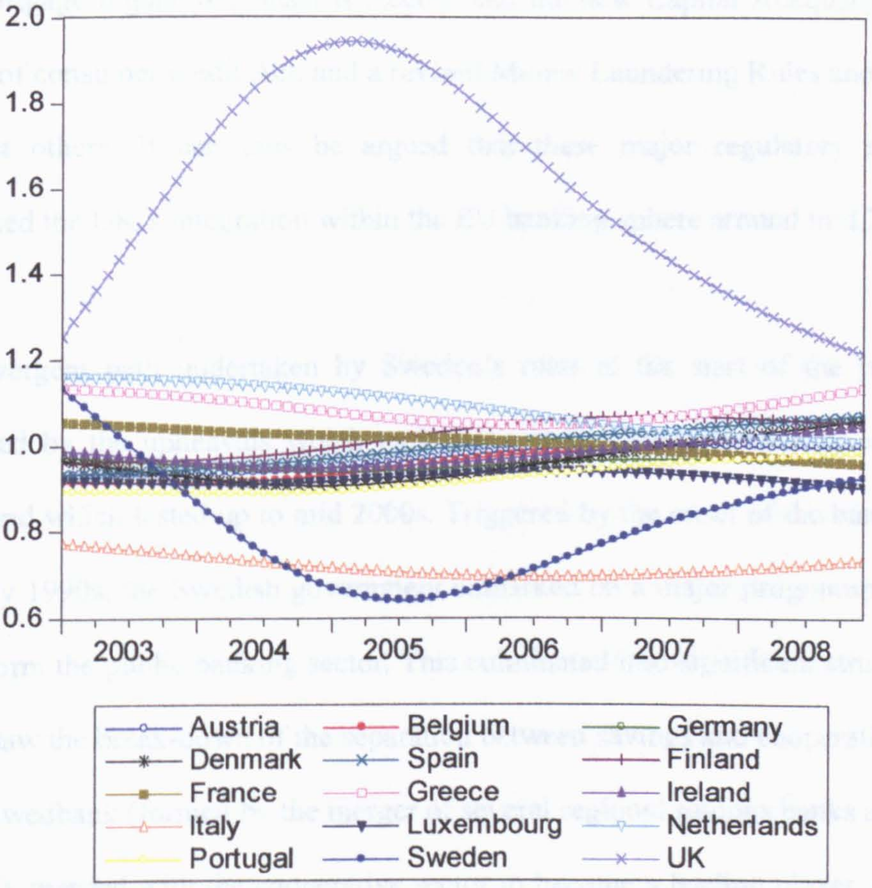
[58] Ireland and Italy also happen to be among those countries that do not show any cointegration.

behaviour and this can actually be linked to the cointegration analysis whereby no cointegration is detected for most of these countries. The reasons for such behaviour can be linked to the heterogeneous nature of the domestic retail markets for these countries and this has been extensively discussed in section 5.4.1. Hence, although strong convergence is present for the deposit rates for the 1990-2002 period, it seems that the process did not kick-start until the late 1990s.

5.10.2.2 Panel results for the deposit rates (1 year maturity) for the period 2003-2008

The sub-club convergence tests reveal the presence of only one cluster, grouping all 15 countries, for the short term deposit rates for the period 2003-2008. A fast speed of convergence is also observed ($\hat{b}$=1.523). These strong convergence results are depicted in Figure 5.14 below where it can be observed that the deposit series for the panel of 15 countries are closely clustered and moving asymptotically towards one, especially towards mid 2000. The other noticeable fact is that the transition paths for UK, Sweden and Italy start by moving away from the cross-section average but end up converging along the same lines as the other countries in the panel.

Figure 5.14 Transition paths for each country's 1-yr deposit rates



With regards to the UK, the unique characteristics of the UK banking market such as a generally higher concentration and profitability ratios; a significantly lower savings ratio (linked to developments in the housing market) compared to the EU average, combined with the fact that it is outside the Euro-zone could well explain the divergent path undertaken by UK's deposit rates at the start of the period investigated. However, towards the middle of 2004 and 2005, the transition path takes a dramatic turn and starts converging towards the EU cross-section average. This turn of event coincides with the numerous regulatory reforms that were undertaken by the UK during this period. As reported by the British Bankers Association (2004), over the period 2005, the UK banking industry was going to address and implement several European legislation and regulation such as 28 EU Directives stemming from the Financial Services Action Plan, the Consumer Credit and Unfair Commercial Practices Directives, General Insurance and Mortgage regulation, Basel II Accord and the new Capital Adequacy Directive, a review of consumer credit Act, and a revised Money Laundering Rules and Regulations, amongst others. It can thus be argued that these major regulatory reforms have catapulted the UK's integration within the EU banking sphere around mid 2000s.

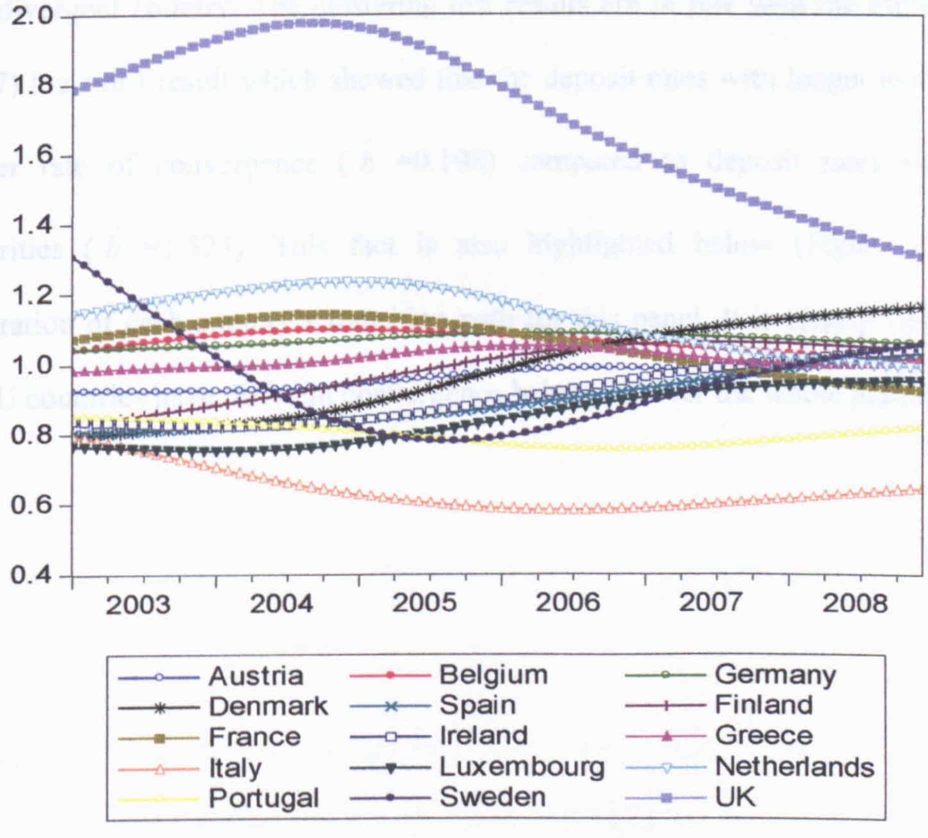
The divergent path undertaken by Sweden's rates at the start of the period can be explained by the upheavals which took place in the Swedish banking market in the 1990s and which lasted up to mid 2000s. Triggered by the onset of the banking crisis in the early 1990s, the Swedish government embarked on a major programme to privatise and reform the public banking sector. This culminated into significant structural change which saw the break-down of the separation between savings and cooperatives banks. In 1997, Swedbank (formed by the merger of several regional savings banks and privatised in 1995), merged with the cooperative sector to become a leading player, alongside the other three big banks. Further reforms were pursued between 1998 to 2003, which ultimately transformed the Swedish banking sector from a fragmented banking market to a more competitive more. Since, the Swedish banking market has stood out as being highly concentrated, acutely competitive and highly profitable (Polster, 2004a). Hence, it can be advanced that the lack of convergence witnessed in Sweden's rates at the beginning of the period until 2004-2005, can be attributed to the major structural and consolidation programme going on at the time. The focus was on the domestic market rather than on the European banking sector. Since, other developments such as the expansion of other distribution channels such as online banking, further increases in lending and an increase in foreign activities especially in the Nordic countries seem to have taken Sweden's path towards the rest of the EU countries.

In the case of Italy, along the same vein as above, the initial move away from the cross-section average could be attributed to the major deregulation and privatisation reforms that were kick-started in the late 1990s. This resulted in the creation of universal banks and a much more competitive Italian banking market. These reforms were also a product of the EU's intended programme for a single market in banking which would eventually lead to the entry of new competition in the Italian banking market. Consequently, the Amato Law of 1990 was launched and by 1992/3, the 83 savings banks had been transformed into public limited companies. However, the newly privatised banks were still largely under the control of the state. Subsequently the Ciampi Law of 1998 was passed to increase the efficiency of the Italian banking market by changing the organisational structure of the banks. The new privatised banks had until 2003 to dismantle their existing structure and reduce the state's stake. During this period, various other laws and regulations were launched and adopted to further boost the efficiency and competitiveness of the Italian banking sector. As a result, several mergers and acquisitions also took place (Polster, 2004b). Hence, the subsequent convergence in the transition path for Italy can be attributed to the positive results of the consolidation and privatisation programme in the domestic market.

5.10.2.3 Panel results for the deposit rates (1-2 years' maturity) for the period 2003-2008

The clustering test results for the deposit rates with medium-term maturities for the 15 EU countries shows a similar convergence process as for the deposit rates with shorter-term maturities. Once again, all 15 EU countries belong to just one sub-club pointing out to retail banking integration in this market. However, the speed of convergence is much slower for this panel set ($\hat{b}$ =0.881). This fairly pronounced degree of convergence is also illustrated below (Figure 5.15) in the behaviour of the panel of countries' transition paths.

Figure 5.15 Transition paths for each country's 1-2 years' deposit rates

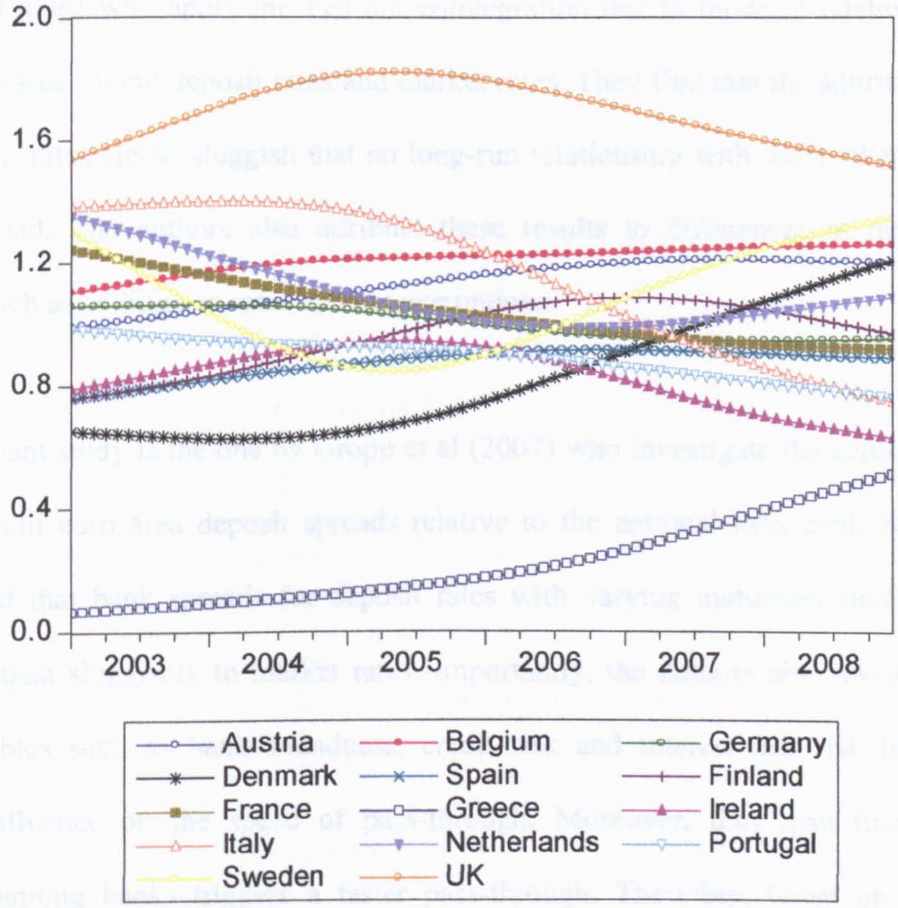


Based on Figure 5.15, it can be seen that, at the start of the period, the transition paths for UK and Sweden diverge from the cross-section average of one but slowly moves towards the average around 2005. This was evident too for the deposit rates with shorter maturities and the same reasons, as discussed in Section 5.10.2.2, can be cited as explanations for such behaviour.

5.10.2.4 Panel results for the deposit rates (>2years' maturity) for the period 2003-2008

With regards to the household deposit rates with over 2 years' maturity, once more, just 1 sub-cluster is identified, grouping 13 out of the 14 countries in the sample but a much slower speed of convergence is noted. The 14th member, Ireland, is actually identified as a divergent country. The clustering test results are in line with the Phillips and Sul (2007) log *t*-test result which showed that the deposit rates with longer maturities have slower rate of convergence ($\hat{b}$ =0.198) compared to deposit rates with shorter-maturities ($\hat{b}$ =1.523). This fact is also highlighted below (Figure 5.16) in the illustration of each country's transition path for this panel. It is clearly visible that the 14 EU countries have different convergence behaviour over the whole period.

Figure 5.16 Transition paths for each country's over 2years' deposit rates



The major observation here is that the convergence process seems definitely slower or more diverse when deposit rates with longer maturities are tested as opposed to deposit rates with shorter maturities. The explanation for the variation in the convergence process can be drawn from a theoretical perspective. As widely discussed, long-term interest rates reflect financial market expectations of future inflation, economic developments and interest rates set by the central banks. Hence, by inference, long-term interest rates are determined by economic conditions at country-level and as such wide disparities are bound to exist between the panel of 15 EU countries. This would, in turn, translate into weaker integration with the retail banking sector. Moreover, as discussed in various interest pass-through literature, given the nature of the retail banking sector where regulatory and institutional barriers are rife, retail banking rates tend to adjust more slowly to competitive market rates. Of particular interest is the study by Sorensen and Werner (2006) who apply the Pedroni cointegration test to model a relationship between euro-area saving deposit rates and market rates. They find that the adjustments for the deposit rates are so sluggish that no long-run relationship with the market rates can be detected. The authors also attribute these results to differences in national regulations such as ceilings on rates and tax exemptions.

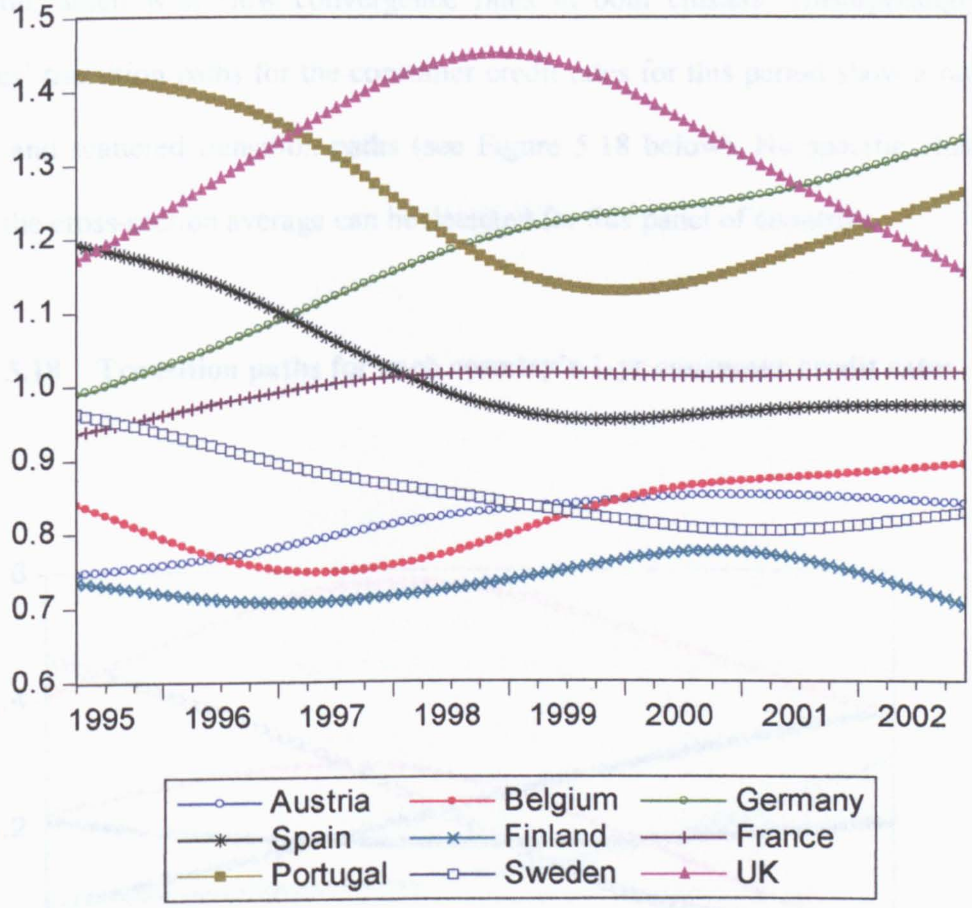
Another relevant study is the one by Gropp et al (2007) who investigate the adjustment process of retail euro area deposit spreads relative to the national inter-bank deposit rates and find that bank spreads for deposit rates with varying maturities (including long-term) adjust sluggishly to market rates. Importantly, the authors also reveal that control variables such as bank soundness, credit risk and interest rate risk have a significant influence on the speed of pass-through. Moreover, they also find that competition among banks triggers a faster pass-through. Therefore, based on these findings and the Phillips and Sul (2007) test results as discussed above, another notable inference that can be drawn here is that the lesser the degree of competition, the lesser the resulting degree of retail banking integration.

5.10.2.5 Panel results for the consumer credit rates for the period 1995-2002

As discussed in Section 5.10.1.2, the hypothesis of convergence in the panel of consumer credit rates for the period 1995-2002 is rejected by the log *t*-test. The clustering algorithm, on its part, however detects that sub-group convergence among the panel of countries is occurring. Three small sub-groups are identified. The first one groups Belgium, Germany, France, Portugal and UK (($\hat{b}$ = 0.220). The second club comprises Austria and Spain ($\hat{b}$ = 0.279). The third club consists of Finland and Sweden ($\hat{b}$ = 1.068). Hence, even though the panel of 9 countries are not converging as a group, they are nonetheless converging within separate clusters and at different speeds. The clustering of the sub-groups is quite interesting, as it seems to indicate the importance of regional proximity in the consumer credit market. For instance, the first club groups Belgium, Germany and France. In their hierarchical cluster analysis undertaken in the euro area, Sorensen and Guitierrez (2006) find similar results for these 3 countries. Furthermore, the grouping in the third club (Finland and Sweden) may also be reflecting geographical and structural similarities.

Unsurprisingly, the countries' transition paths, as depicted below in Figure 5.17, show no common behaviour for most of the 1995-2002 period. Towards the start of the years 2000, it can however be observed that the transition paths for most of the countries in the sample are slowly moving towards the cross-section average. The lack of integration in the consumer lending market for the 1990s period has already been discussed in the log t test panel convergence Section 5.10.1.2.

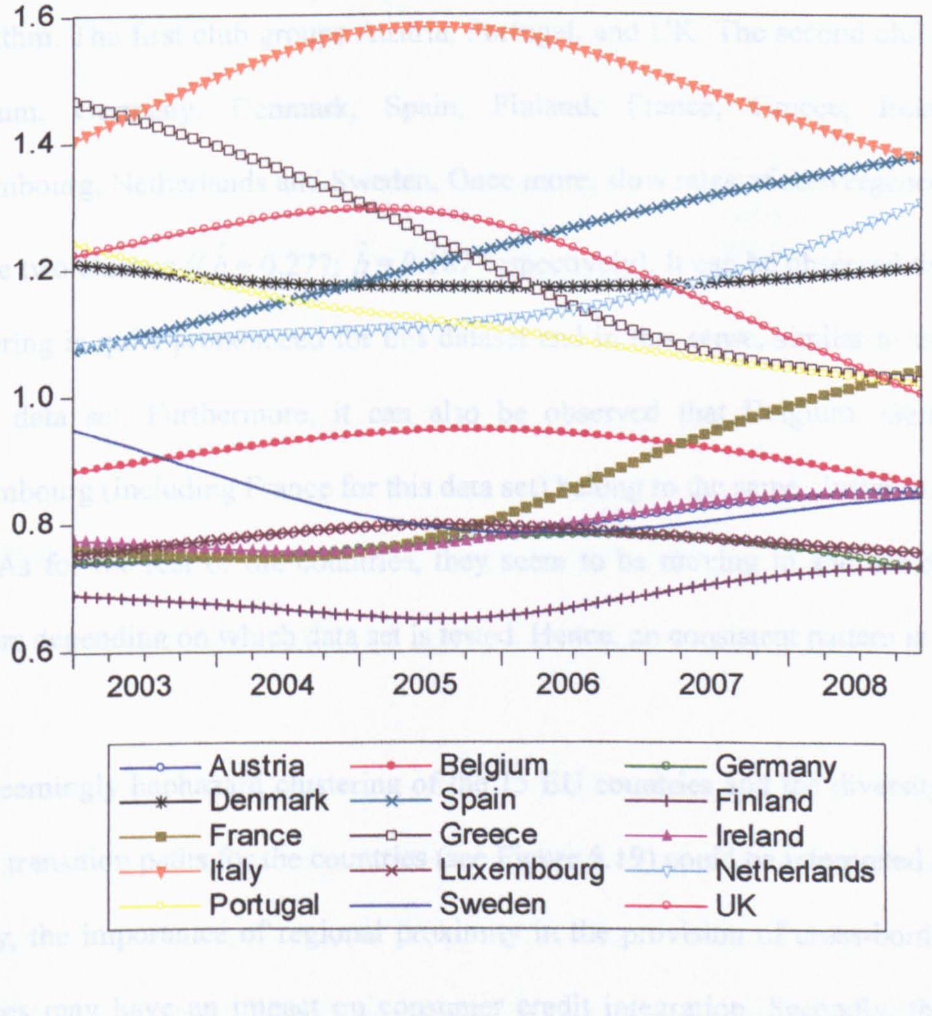
Figure 5.17 Transition paths for each country's consumer credit rates



5.10.2.6 Panel results for the consumer credit rates (1 year maturity) for the period 2003-2008

Along similar lines as the findings discussed in Section 5.10.2.5 above, sub-club convergence is also detected for the short-term consumer credit rates for the 2003-2008 period. Two clusters are identified. The first one groups Austria, Denmark, Spain, Finland, France, Ireland, Italy, Netherlands, Portugal and Sweden. Even though, the grouping for this first cluster is large, the rate of convergence, on the other hand, is extremely weak ($\hat{b}$ =0.002). The second cluster consists of Belgium, Germany, Greece, UK and Luxembourg and again a slow rate of convergence is noted ($\hat{b}$ =0.348). So even though the whole panel of short term consumer credit is not converging, as evidenced by the log t-test, the club clustering test reveals the presence of club formation, albeit with slow convergence rates in both clusters. Unsurprisingly, the countries' transition paths for the consumer credit rates for this period show a range of diverse and scattered transition paths (see Figure 5.18 below). No specific clustering around the cross-section average can be detected for this panel of countries.

Figure 5.18 Transition paths for each country's 1-yr consumer credit rates



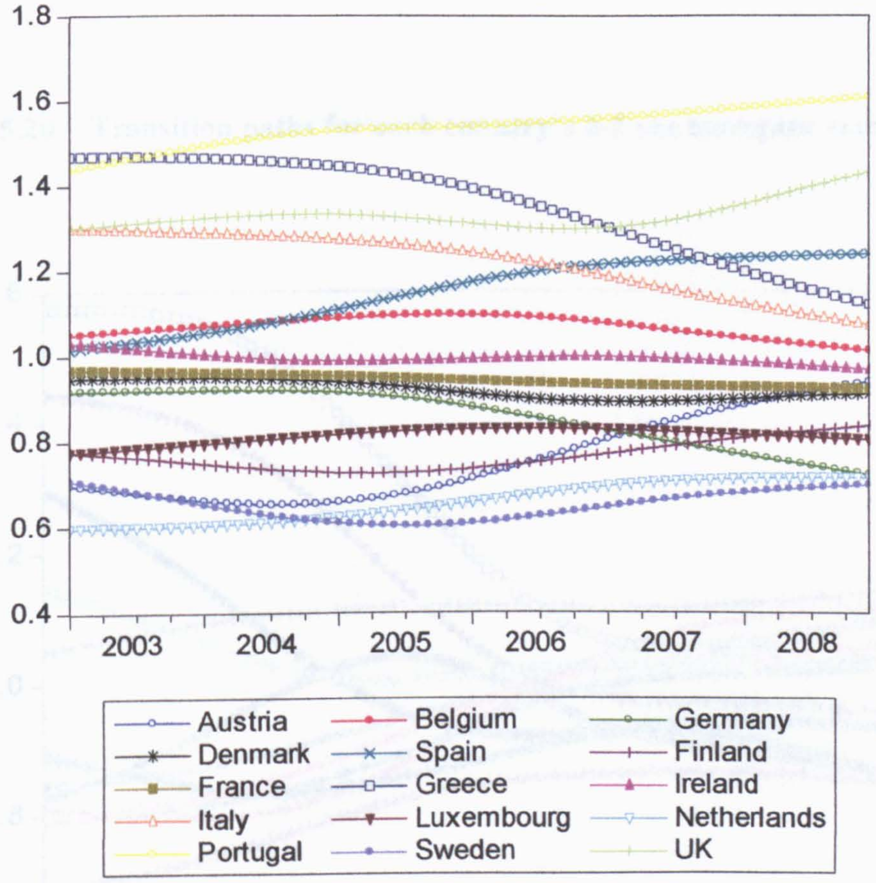
The above results support the results obtained under the group panel convergence test results for this data series (see Section 5.10.1.2). Furthermore, these results are similar to those obtained by Vajanne (2007) who also rejects the hypothesis of convergence for consumer credit rates with shorter maturities. Her study finds that the spreads for this instrument category are very large and attributes these findings to the variety of credit products that exist in the European Union.

5.10.2.7 Panel results for the consumer credit rates (1-5 years' maturity) for the period 2003-2008

With regards to the consumer credit rates with medium-term maturities for the period 2003-2008, 2 sub clusters are identified by the Phillips and Sul (2007) club clustering algorithm. The first club groups Austria, Portugal, and UK. The second club comprises Belgium, Germany, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Luxembourg, Netherlands and Sweden. Once more, slow rates of convergence are noted for the two clusters (($\hat{b} = 0.277$; $\hat{b} = 0.187$ respectively). It can be observed that the sub-clustering is quite pronounced for this dataset and in this sense, similar to the previous panel data set. Furthermore, it can also be observed that Belgium, Germany, and Luxembourg (including France for this data set) belong to the same cluster in both panel sets. As for the rest of the countries, they seem to be moving in and out of different clusters depending on which data set is tested. Hence, no consistent pattern is evident.

The seemingly haphazard clustering of the 15 EU countries and the diversity observed in the transition paths for the countries (see Figure 5.19) could be interpreted as follows. Firstly, the importance of regional proximity in the provision of cross-border banking services may have an impact on consumer credit integration. Secondly, these results could also reflect the inherent national characteristics of retail banking such as varying market structures, and legal and regulatory framework, amongst others.

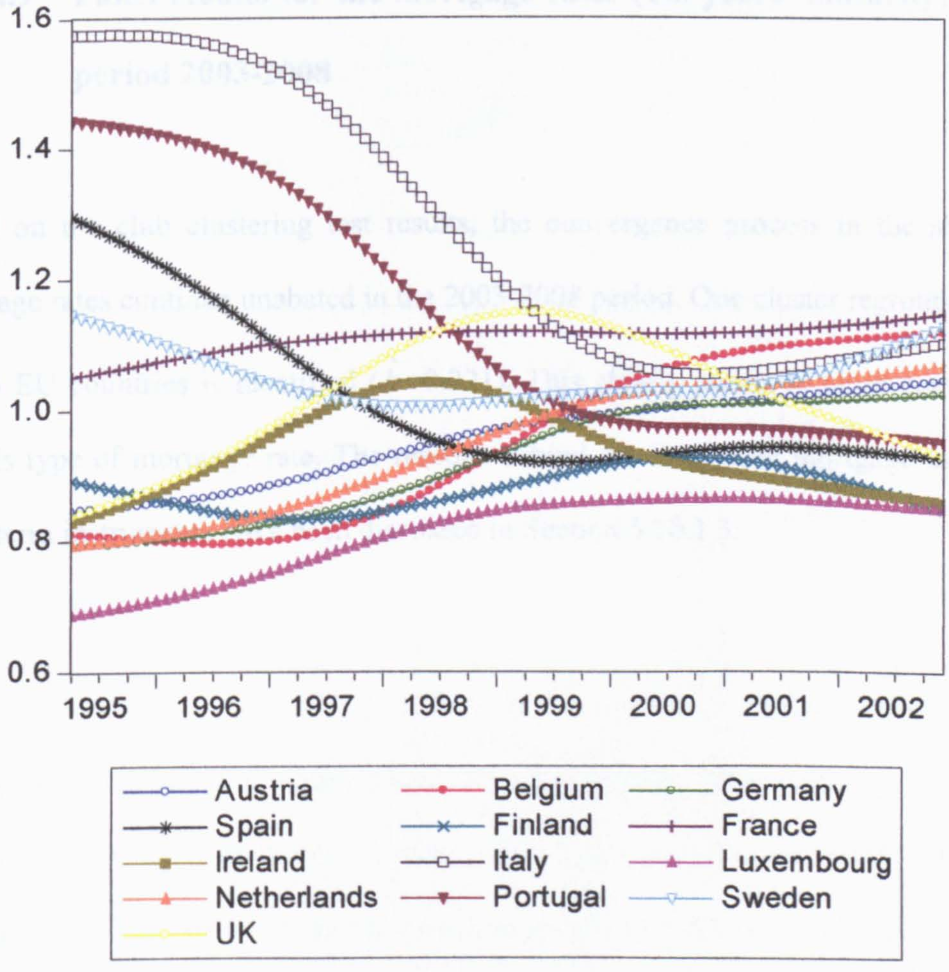
Figure 5.19 Transition paths for each country's 1-5 years' consumer credit rates



5.10.2.8 Panel results for the mortgage rates (2-5 years' maturity) for the period 1995-2002

With regards to the mortgage rates with 2-5 years maturity for the 1995-2002 period, the Phillips and Sul (2007) algorithm identifies two clubs. The first one groups Austria, Belgium, Germany, Spain, France, Italy, Netherlands, Portugal, Sweden and UK while the second club groups Finland, Ireland and Luxembourg. With regards to the speed of convergence, a much faster convergence rate is noted for the second club ($\hat{b}$=4.893) compared to the first club grouping most of the countries ($\hat{b}$ =0.333). The strong convergence results obtained here are in line with the earlier cointegration analysis in Section 5.4.3, which shows that most the countries in the sample have one cointegration equation.

Figure 5.20 Transition paths for each country's 2-5 yrs mortgage rates

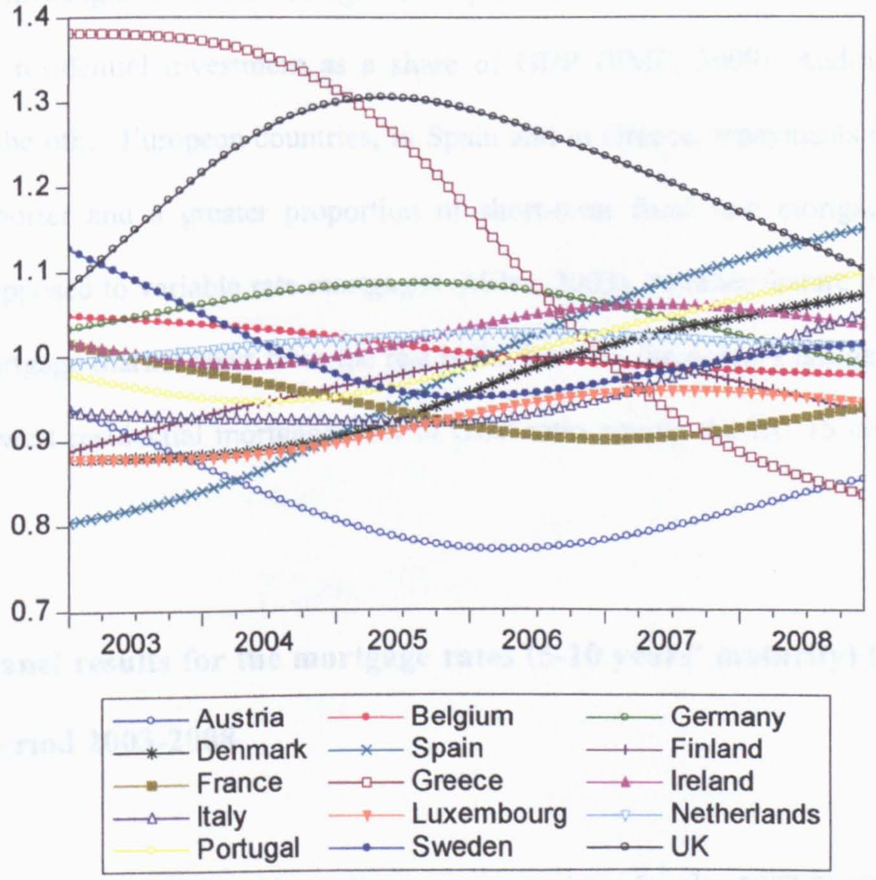


As seen in Figure 5.20 above, the path of the transition coefficients for the panel of countries for the short-term mortgage rates for the 1990s period, underpin the positive convergence results obtained under the bivariate cointegration tests, as well as the panel unit root tests, log *t* and club clustering tests. From the behaviour of the convergence paths, it is evident that convergence was less pronounced at the start of the period but became more clustered towards 1999/2000. The paths for Italy and Portugal in particular have a high positive slope initially but eventually merge with the rest of the panel towards the cross-section average. The move towards the cross-section average for most countries towards the end of the period coincides with the initiatives of the Single Market programme and the launch of the euro.

5.10.2.9 Panel results for the mortgage rates (1-5 years' maturity) for the period 2003-2008

Based on the club clustering test results, the convergence process in the short-term mortgage rates continue unabated in the 2003-2008 period. One cluster regrouping all of the 15 EU countries is identified ($\hat{b}$=0.221). This clearly points to close convergence for this type of mortgage rate. The reasons behind the integrated mortgage market for short-term instruments have been discussed in Section 5.10.1.3.

Figure 5.21 Transition paths for each country's 1-5 years' mortgage rates



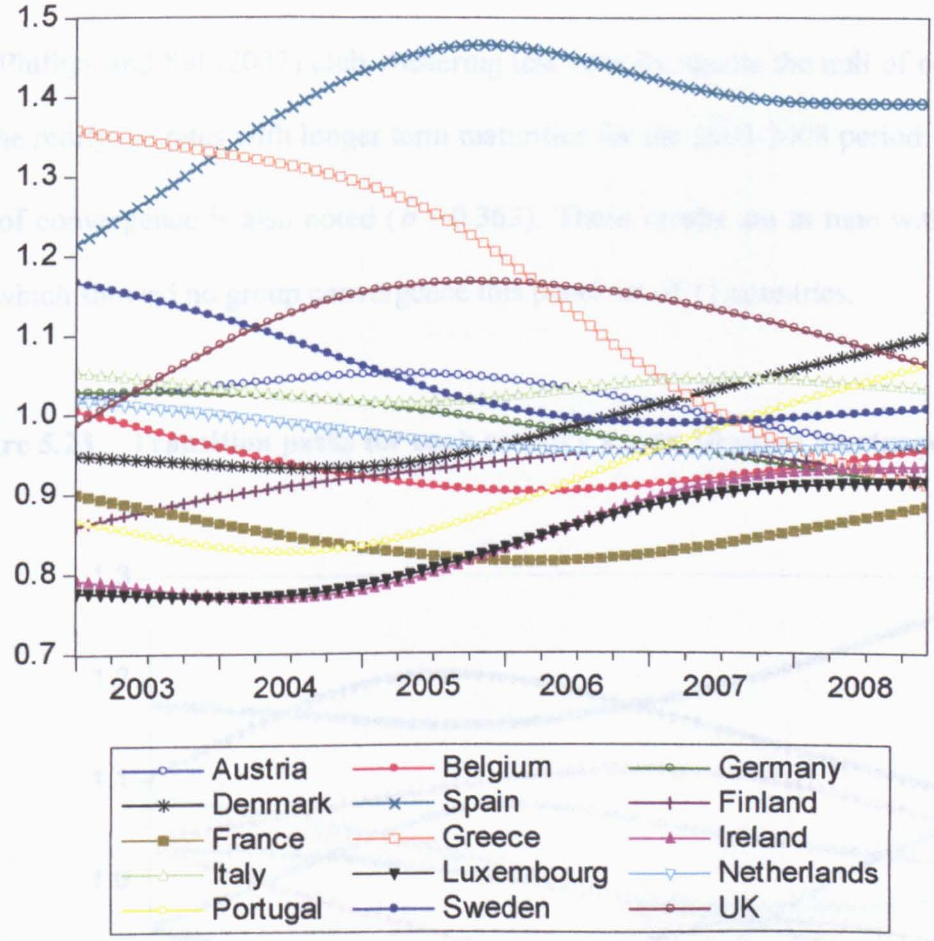
The transition paths shown in Figure 5.21 for the short-term mortgage rates, highlight the convergence detected in this panel for most countries. However, the behaviour of the time paths for 4 countries (Sweden, UK, Spain and Greece) needs mentioning. Firstly, it can be observed that the transition coefficients for Sweden and UK start by moving away from the panel cross section average but change course around 2005. These patterns have been observed in the case of the deposit rates and the explanations for such behaviour have already been discussed in Section 5.10.2.2.

In the case of Spain, a study by Sorensen and Werner (2006), which looks at the interest rate pass-through for various mortgage rates for the euro-area countries, makes the observation that the mortgage rates for Spain tend to adjust more slowly than other countries. Interestingly, this fact is corroborated above in the illustration of Spain's transition path. Furthermore, the housing boom that took place in Spain during the period under investigation cannot be ignored. Spain consistently showed the highest proportion of residential investment as a share of GDP (EMF, 2009). Additionally, compared to the other European countries, in Spain and in Greece, repayments periods tend to be shorter and a greater proportion of short-term fixed rate mortgages are available as opposed to variable rate mortgages (Miles, 2003). Another feature that sets the Greek mortgage market apart from the rest is the fact that the country has generally one of the lowest residential mortgage debt to GDP ratio among the EU 15 countries (EMF, 2009).

5.10.2.10 Panel results for the mortgage rates (5-10 years' maturity) for the period 2003-2008

The panel for mortgage rates with medium-term maturities for the 2003-2008 period also show closely clustered convergence patterns for the 15 EU countries. The clustering algorithm reveals only one sub-club grouping all the 15 EU countries. The speed of convergence ($\hat{b}$=0.281) is also similar to that of the 1-5 years mortgage panel for the same period.

Figure 5.22 Transition paths for each country's 5-10 years' mortgage rates

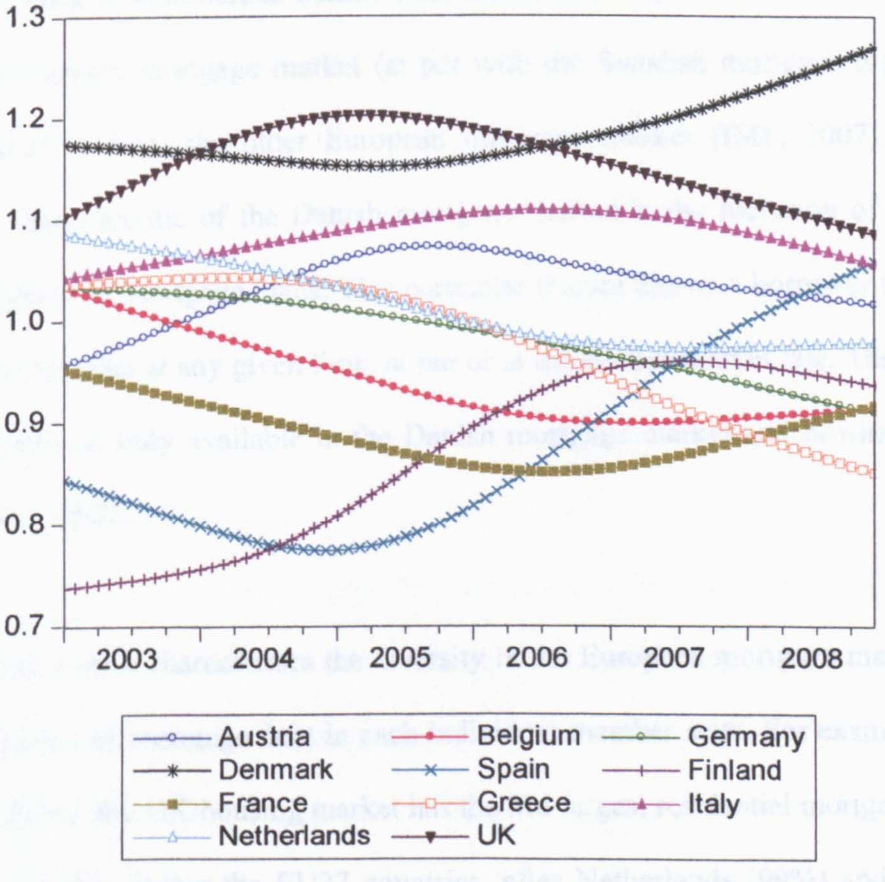


The transition paths, as illustrated in Figure 5.22, for the mortgage rates with medium term maturities show general similarities between the countries in the sample, with concentration visible around the cross-section average. Interestingly, it is also apparent that the behaviour of the transition coefficients for Spain and Greece take different paths from the rest of the group. The reasons cited above in Section 5.10.2.9 provide an interpretation of these two countries' paths. It should also be pointed out that the clustering seems much less concentrated around the cross-section average compared to the mortgage rates with short-term maturities.

5.10.2.11 Panel results for the mortgage rates (> 10 years' maturity) for the period 2003-2008

The Phillips and Sul (2007) club clustering test actually rejects the null of convergence for the mortgage rates with longer term maturities for the 2003-2008 period. A negative rate of convergence is also noted ($\hat{b}$=-0.363). These results are in tune with the log t-test which showed no group convergence this panel set of 11 countries.

Figure 5.23 Transition paths for each country's over 10 years mortgage rates



Along the same vein, the transition paths depicted above in Figure 5.23 show the very diverse behaviour of the transition paths of the countries in the panel. For instance, Spain's and Denmark's transition paths start with a negative slope but change direction around 2005 to continue on an upward slope. The opposite can be observed for UK and Greece. Overall, it can be observed that the mortgage rates with longer maturities show no convergent behaviour as compared to similar instruments with shorter maturities.

The diversity illustrated in Figure 5.23 can also be explained by the heterogeneity that exists in the European mortgage markets. For instance, in Denmark, the mortgage market is characterised by a strict regulatory framework whereby mortgage credit institutions are the only financial institutions that are allowed to offer residential mortgages and their activities are limited to the issuance, servicing and funding of mortgages. As at 2007, there were 8 mortgage credit institutions in Denmark, some of which are linked to commercial banks. This feature not only make Denmark the most highly concentrated mortgage market (at par with the Swedish mortgage market) but also distances it from the other European mortgage market (IMF, 2007). Another distinctive characteristic of the Danish mortgage market is the inclusion of "call and delivery option" in mortgage loans. This particular feature allows a borrower to pre-pay or buy-back his loan at any given time, at par or at the current market rate. This call and delivery option is only available in the Danish mortgage market and nowhere else in Europe (IMF, 2007).

Another feature that characterises the diversity in the European mortgage market is the varying amount of mortgage debt in each individual member state. For example, based on 2008 figures, the UK housing market has the 3rd largest residential mortgage debt to GDP ratio (81%) among the EU27 countries, after Netherlands (99%) and Denmark (95%). On the other hand, Italy and Finland, the other two countries on the list, have the lowest mortgage debt to GDP ratio at 20% and 25% respectively (EMF, 2009). Italy also happens to have one of the highest owner-occupation ratios at 80% (based on

2007/8 figures) compared to the other EU countries which tend to average around 57-59% (EMF, 2009). Furthermore, in the UK for example, mortgages rates tend to be based on variable rates or tracker rates compared to the rest of Europe where fixed rate mortgages are generally the preferred instruments. In fact, in some countries, the variability of interest rate on house loans to households is limited by law. For instance, in Belgium, Spain and Portugal, changes in interest rates for variable mortgage loans must be linked to a specific index, normally a government bond yield or market index (ECB, 2006).

Amongst the entire panel data sets tested, the mortgage series with over 10 year's maturities is the only one where the results sharply contrast with the panel unit root tests. Given the power of the Phillips and Sul (2007) convergence tests combined with the analysis of the weak results discussed in this section as well as evidence drawn from both a theoretical perspective and based on anecdotal information (see Section 5.10.1.3), this research puts forward the view that no convergence is present for longer-term mortgage rates.

5.11 Conclusions

The aim of this chapter is to conduct a thorough empirical investigation of the convergence process in European retail banking sector by analysing deposit, consumer credit and mortgage rates to the household sector for the period 1991 to 2008. An important contribution of this chapter is the application of methodologies that have not been hitherto employed in the literature on European banking integration. Firstly, cointegration methods are applied to deposit and lending series for the period 1991-2008. Secondly, the stochastic multiple structural break model developed by Bai and Perron (1998) is applied to individual deposit and lending spread series. This procedure is chosen so as to detect whether these series have been subject to structural change and whether the timings in the break dates coincide. Thirdly, panel unit root tests, which have more power than the time series tests, are applied to the data sets. The presence of structural breaks is factored in order to draw parallels between the results obtained for the original spreads versus demeaned spreads. Thirdly, this research is the first one to apply the recently developed Phillips and Sul (2007) convergence test to retail interest rates. The use of this test is a major contribution of this chapter as the Phillips and Sul (2007) methodology not only detects the presence and degree of integration but also provides an estimate of the speed of convergence. Additionally, the club clustering algorithm indicates whether sub-groups of countries are converging or showing divergent behaviour. The Phillips and Sul (2007) regression-based tests of convergence provide both flexibility and robustness due to the time varying factor representation. This panel methodology is superior to the time series cointegration approach as it models long run equilibrium while allowing for individual heterogeneity which can evolve over time. Hence, this procedure brings a novel and deep insight into the study of the European retail banking sector.

The main findings of this chapter are as follows. Firstly, the application of bivariate cointegration tests to the data series and the corresponding weighted European average rates point to a fragmented retail banking sector for the period 1991-2008. These results are in line with the literature which point to very low level of retail integration especially in the 1990s. These results are attributed to various impediments like institutional differences such as an array of consumer protection laws, different credit registers and product lines and various demand and supply constraints. Secondly, the structural break test on the spreads series reveal the presence of between two to four breaks for the period 1991/5 to 2002 and 2003-2008. Interestingly, it is noted that these breaks tend to be clustered around specific events such as the Capital Adequacy Directive of 1993 / 2006 and the launch of the Financial Services Action Plan in 1998. Hence, it is reasonable to argue that these major overhauls in the European banking arena are bound to lead to common shocks in the interest rates at country-level.

In contrast to the cointegration results, the IPS and CIPS panel unit root methodologies which are applied to the spreads, show that convergence was present in the retail banking sector for all types of instruments right from the 1990s. The 2003-2008 panel unit root test also produce strong evidence that the integration was present in this period. Interestingly, for several of the panel data-sets, the null of a unit root (non-stationarity) cannot be rejected when the original spread data sets are tested. However, when the IPS and CIPS tests are run on the demeaned spreads data sets, the presence of stationarity and hence convergence is strongly detected (even at 1% significance level) for the majority of the 11 retail instruments for the period 1991-2002 and 2003-2008.

As for the results obtained under the Phillips and Sul tests, some interesting findings are noted. In general, the overwhelming presence of convergence is noted for all the deposit rates panels, for most of the mortgage rate panels while a mixed picture emerges for the consumer credit rates. Firstly, with regards to the deposit rates panels, the log-t test and club test show strong convergence. However the speed of convergence varies. A noticeably faster rate of convergence is observed for the shorter-term deposit rate panels. The behaviour of the transition paths for individual countries in the panel also mirrors this fact by illustrating a more diverse convergence process for the deposit rates with longer maturities. On the whole, the Phillips and Sul results are in line with the panel unit root test results regarding group convergence.

Secondly, with regards to the consumer credit rates panels, under the log t test, the null of group convergence is actually rejected for all the consumer credit rates for the period 1991/5 -2002 and 2003-2008, irrespective of the maturity duration. However, the club clustering tests indicates the presence of convergence by revealing the presence of up to 3 clusters. However, each one of them exhibits a typically slow convergence speed. The transition paths for the individual countries in all 3 panels also highlight the presence of heterogeneity in the consumer credit market since the 1990s. On the whole, the log t-test results are in sharp contrast to the panel unit root tests which indicate strong convergence. However, given the power of the Phillips and Sul test, more weight is hereby given to the consumer credit results based on this test.

Thirdly, with regards to the mortgage data panels, based on the Phillips and Sul tests results, the presence of convergence is detected for 4 out of the 5 panels, including the 1995-2002 mortgage panel. As for the 5th mortgage panel which carries the longest maturities, the null of convergence is rejected under both the log t-test and the club test. Another notable fact is that relatively faster speed of convergence is observed for the panels with shorter maturities compared to the medium term ones. The behaviour of the transition paths also underpins these findings. On the whole, the results obtained under the Phillips and Sul log *t*-test are generally in tune with the panel unit root results (except for the mortgage rates with longer maturities.) but not in line with the bivariate cointegration results.Once more, based on the power of the Phillips and Sul test, the conclusion that is formulated is that, in the mortgage market for long term instruments, no convergence is present.

So overall, based on the results obtained under different methodologies, it can be asserted that the retail banking sector for the household market is converging, especially in the deposit and mortgage market. This integration process is evident right from the 1990s. Furthermore, it can be observed that especially in the case of mortgage instruments, stronger convergence is detected for rates with shorter maturities as opposed to rates with longer maturities. As for the consumer credit rates, it shows signs of being the most heterogeneous market although convergence is detected at sub-group level. Geographical proximity and similarities in structural characteristics may be the determining factors in this case.

Appendix 5A Additional information on the data series

5AI: Households sector

1. Short-term deposit rates to the households sector [1991-2002]

Data description: Short-term time deposit rates, with up to 1 year maturity[59] to households
Countries: Belgium, Germany, France, Portugal, Netherlands
Source: ECB Database [N8, N8-1, N8-2] / IMF Database (NL)

Data description: Deposit rates to households [maturity unknown]
Countries: Italy, Denmark, Ireland, Greece, Finland, Sweden[60], Spain
Source: ECB Database [N9, N9-1, N10, N10-1]

Data description: "Savings rates from Datastream (91-94)" merged with "ECB N8 Savings rates with up to 12 months' maturity (95-02)"
Country: Austria
Source: Datastream /ECB database [N8]

Data description: "Average deposit rate for 4 main clearing banks (91-94)" merged with "ECB N8: 90 day time deposit (95-02)"
Country: UK
Source: IMF database / ECB Database [N8]

2. Deposit rates with up to 1 year maturity to the households sector [2003-2008]

Data description: Deposits with up to 1 year maturity to the households & and non-profit institutions serving households (S.14 & S.15) sector, New business coverage, in Euro
Countries: Austria, Belgium, Germany, Denmark (Danish Krone), Spain, Finland, France, Greece, Italy, Netherlands, Portugal, Luxembourg, Ireland[61]
Source: ECB Database

Data description: "Monthly average of UK resident banks' sterling weighted average interest rate, interest bearing sight deposits from households (Jan –Dec 03)" merged with "Monthly average of UK resident banks' sterling weighted average interest rate - time deposits with fixed original maturity <=1 year from households (Jan 04-Dec 08)"
Country: UK
Source: Bank of England database

Data description: "Banks' average deposit rates[62], period ending stock, to the household sector [2003-2005]" merged with "ECB deposits with up to 1 year maturity to the households & and non-profit institutions serving households sector"
Country: Sweden
Source: Riksbank Database /ECB Database

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[59] Deposit rates for BE, DE, FR NL have 3 months' maturity. Deposit rates for PT has 31-90 days' maturity
[60] Quarterly data has been converted to monthly data using the Cubic Spline method
[61] Deposits with up to 2 years maturity, and outstanding amount business coverage.
[62] Quarterly data have been converted to monthly data using the Cubic spline method

3. Deposit rates with over 1 year and up to 2 years maturity to the household sector [2003-2008]

Data description: Deposits with over 1 and up to 2 years' maturity to the households and non-profit institutions serving households (S.14 & S.15) sector, New business coverage, in Euro
Countries: Austria, Belgium, Denmark (D. Krone), Germany, Spain, Finland, France, Greece
Source: ECB Database

Data description: Deposits with up to two years maturity to the households and non-profit institutions serving households (S.14 & S.15) sector, Outstanding amount business coverage, in Euro
Countries: Ireland, Italy, Netherlands, Portugal, Luxembourg
Source: ECB Database

Data description: "Banks' average deposit rates[63], period ending stock, to the household sector [2003-2005]" merged with "ECB Deposits with over 1 and up to 2 years maturity, New business coverage, Swedish krona to the Households (Aug 05-Dec 08)"
Country: Sweden
Source: Riksbank Database /ECB Database
Data description: "Monthly average of UK resident banks' sterling weighted average interest rate, time deposits from households (in percent) not seasonally adjusted (Jan-Dec 03)" merged with "Monthly average of UK resident banks' sterling weighted average interest rate - new time deposits with a fixed original maturity >1yr<=2yrs from households (in percent) not seasonally adjusted (04-08)"
Country: UK
Source: Bank of England Statistical Database

4. Deposit rates with over 2 years' maturity to the households sector [2003-2008]

Data description: Deposits with over 2 years' maturity to the households and non-profit institutions serving households (S.14 & S.15) sector, New business /Outstanding amount coverage, in Euro
Countries: Austria, Belgium, Denmark (D. Krone), Germany, Spain, Finland, France, Greece, Ireland, Italy, Portugal, Netherlands
Source: ECB Database

Data description: "Banks' average deposit rates, period ending stock, to the household sector [2003-2005]" merged with "ECB Deposits with over 2 years maturity to households, New business coverage, in Swedish krona [2005-2008]"
Country: Sweden
Source: Riksbank Database / ECB Database

Data description: "Monthly average of UK resident banks' sterling weighted average interest rate, time deposits from households (in percent) not seasonally adjusted (Jan-Dec 03)" merged with "Monthly average of UK resident banks' sterling weighted average interest rate - new time deposits with a fixed original maturity >2yrs from households (in percent) not seasonally adjusted (04-08)"
Country: UK

[63] Quarterly data have been converted to monthly data using the Cubic spline method

Source: Bank of England Statistical Database

5. Consumer loans rates to households [1995-2002]

Data description: Secured /unsecured consumer credit to the households sector
Countries: Austria, Belgium, Germany[64], Spain[65], Finland, France[66], Portugal
Source: ECB Database [N3]

Data description: Consumer credit to households -quarterly data has been converted to monthly data using the Cubic Spline method.
Country: Sweden
Source: Riksbank Database

Data description: "Lending to households: unsecured personal loans, new business coverage [1995-1999]" merged with "Monthly average of UK resident banks' sterling weighted average interest rate, other loans to households (in percent) not seasonally adjusted [1999-2002]"
Country: UK
Source: ECB Database N3-1 / Bank of England Database

6. Consumer loans rates with up to 1 year maturity to households [2003-2008]

Data description: Consumer credit excl. bank overdrafts [A21-A2Z] with up to 1 year maturity to the households and non-profit institutions serving households (S.14 & S.15) sector, New business coverage, in Euro
Countries: Austria, Belgium, Germany, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Luxembourg[67], Netherlands, Portugal
Source: ECB Database

Data description: "Consumer credit[68] to the household sector [2003-2005]" merged with "ECB Consumer credit to households with 1 year maturity, new business [2005-2008]"
Country: Sweden
Source: Riksbank Database / ECB Database

Data description: Monthly average of UK resident banks' sterling weighted average interest rate, other loans to households (in percent) not seasonally adjusted
Country: UK
Source: Bank of England database

7. Consumer loans rates with over 1 and up to 5 years' maturity to households [2003-2008]

Data description: Consumer credit excl. bank overdrafts [A21-A2Z], with over 1 and up to 5 years maturity to the households and non-profit institutions serving households (S.14 & S.15) sector, New business coverage, in Euro

[64] Consumer instalment credits fixed for 36-60 months
[65] Consumer credit with over 1 year maturity
[66] Quarterly data has been converted to monthly data using the Cubic spline method
[67] Consumer credit with over 1 year maturity
[68] Quarterly data has been converted to monthly data using the Cubic Spline method.

Countries: Austria, Belgium, Denmark (Krone), Germany, Spain, Finland, France, Greece, Italy, Ireland[69], Luxembourg, Portugal, Netherlands[70]
Source: ECB Database

Data description: "Consumer credit[71] to the household sector [03-05]" merged with "ECB -Loans for other purposes excl. bank overdrafts [A23-A2Z] with over 1 and up to 5 years maturity to households, New business coverage, in Swedish krona, [05-08]"
Country:Sweden
Source: Riksbank Database / ECB Database

Data description: "Monthly average of UK resident banks' sterling weighted average interest rate, other loans to households (in percent) not seasonally adjusted (Jan 03-Dec 03)" merged with "Monthly average of UK resident banks' sterling weighted average interest rate - other loans, new advances, initial fixation >1yr<=5yrs to households (in percent) not seasonally adjusted (Jan 04-Dec 08)"
Country: UK
Source: Bank of England database

8. Mortgage rates to the households sector [1995-2002]

Data description: Fixed/variable mortgage rate to households with maturity ranging from 18 months to 5 years
Countries: Belgium, Germany, Spain, Italy, Portugal[72], Netherlands, UK
Source: ECB Database [N2 / N2-2]

Data description: Fixed/floating housing loan rates to households [unknown maturity]
Countries: Austria, Finland, France[73], Ireland, Luxembourg[74] (Luxembourg Central bank data)
Source: ECB Database [N2]

Data description: "Banks' average lending rates, period ending stock, percentage to the Household sector [April 95-May 96]" merged with "Housing credit institutions' lending rates on new agreements to the household sector with 1-5 years maturity [June 96- Dec 2002]", [quarterly data has been converted to monthly data using the Cubic Spline method]
Country: Sweden
Source: Riksbank Database

9. Mortgage rates with over 1 and up to 5 years' maturity to the households sector [2003-2008]

Data description: Loans for house purchases excl. bank overdrafts [A22-A2Z] with over 1 and up to 5 years' maturity to the households and non-profit institutions serving households (S.14 & S.15) sector, New business coverage, in Euro

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69 Consumer credit, outstanding amount coverage, Bank of Ireland
70 Loans for other purposes excl. bank overdrafts [A23-A2Z], Over 1 and up to 5 years maturity, New business coverage
71 Quarterly data has been converted to monthly data using the Cubic Spline method.

72 Over 5 year fixed and floating loans for house purchases (New business coverage)
73 Quarterly data has been converted to monthly data using the Cubic Spline method.
74 Quarterly data has been converted to monthly data using the Cubic Spline method.

Countries: Austria, Belgium, Germany, Denmark, Spain, Finland, France, Greece, Italy, Netherlands, Ireland[75], Portugal[76], Luxembourg[77]
Source: ECB Database

Data description: Monthly interest rate of UK resident banks (excl. Central Bank) and building societies' sterling 3 year (75%LTV) fixed rate mortgage to households (in percent) not seasonally adjusted
Country: UK
Source: Bank of England Statistical Database

Data description: Housing credit institutions' lending rates on new agreements each period broken down by original interest rate period, percentage, to the household sector, 1-5 years maturity
Country: Sweden
Source: Riksbank Database/ ECB Database

10. Mortgage rates with over 5 and up to 10 years' maturity to the households sector [2003-2008]

Data description: Loans for house purchases excl. bank overdrafts [A22-A2Z] with over 5 and up to 10 years' maturity to the households and non-profit institutions serving households (S.14 & S.15) sector, New business coverage, in Euro
Countries: Austria, Belgium, Denmark (Danish Krone), Germany, Spain, Finland, France, Greece, Italy, Netherlands
Source: ECB Database
Data description: Loans for house purchasing with over 5 years' maturity to the households and non-profit institutions serving households (S.14 & S.15) sector, Outstanding amount business coverage, in Euro
Countries: Ireland, Portugal, Luxembourg
Source: ECB Database

Data description: "Housing credit institutions' lending rates[78] on new agreements each period broken down by original interest rate period, percentage, to the household sector with over 5 years maturity (03-05) merged with "ECB- loans for house purchases excl. bank overdrafts, new business, over 5 and up to 10 years maturity, (05-08)"
Country: Sweden
Source: Riksbank Database /ECB Database

Data description: Monthly interest rate of UK resident banks (excl. Central Bank) and building societies' sterling, 5 year maturity (75% LTV) fixed rate mortgage to households (in percent) not seasonally adjusted
Country: UK
Source: Bank of England Statistical Database

[75] Over 1 and up to 5 years maturity, Outstanding amount business coverage
[76] Over 5 years maturity, Outstanding amount business coverage
[77] Over 5 years maturity, Outstanding amount business coverage
[78] Quarterly data converted to monthly data using the Cubic spline method

11. Mortgage rates with over 10 years' maturity to the households sector [2003-2008]

Data description: Loans for house purchases excl. bank overdrafts [A22-A2Z] with over 10 years' maturity to the households and non-profit institutions serving households (S.14 & S.15) sector
, New business coverage, in Euro
Countries: Austria, Belgium, Denmark (Danish Krone), Germany, Spain, Finland, France, Greece, Italy, Netherlands
Source: ECB Database

Data description: Monthly interest rate of UK resident banks (excl. Central Bank) and building societies' sterling 10 year maturity, (75% LTV) fixed rate mortgage to households (in percent) not seasonally adjusted
Country: UK
Source: Bank of England Statistical Database

Appendix 5B

Table 5B.1: ADF unit root tests for the data series for the Household sector

Country	Short-term deposit rates 1991-2002		Deposit rates (1yr) 2003-2008)		Deposit rates (1-2yrs) 2003-2008		Deposit rates (>2yrs) 2003-2008	
	T-statistic for level	T-statistic for 1st difference	T-statistic for level	T-statistic for 1st difference	ADF t-statistic for level	ADF t-statistic for 1st difference	ADF t-statistic for level	ADF t-statistic for 1st difference
Austria [L=0,1,1,1]	-1.749461	-11.19694	-1.854469	-1.863004	-1.030874	-4.239148	-0.566549	-4.414766
Belgium [L=6,1,5,5]	-1.395939	-3.569319	-1.506523	-2.128942	-0.625654	-4.615372	-0.534717	-4.200256
Germany [L=3,1,1,5]	-1.522149	-3.309032	-1.500388	-1.290701	-0.118860	-5.708747	-0.159509	-4.191342
Denmark [L=5,1,6,1]	-1.480782	-3.522288	0.001119	-4.901982	0.303396	-3.530208	-0.235114	-7.481738
Spain [L=2,1,3,3]	-1.431545	-4.225807	-0.484257	-2.750749	0.013605	-3.358881	-0.580298	-4.205747
Finland [L=1,1,0,0]	-2.244688	-5.228166	-1.677145	-2.445014	-0.940390	-3.569054	-1.971009	-8.105173
France [L=11,1,0,1]	-0.924637	-4.109442	-1.183098	-3.136677	-0.997259	-8.624207	-1.751708	-5.197109
Greece [L=9,1,4,0]	0.030029	-3.179449	2.891031	-4.964618	-0.070003	-4.511984	-0.360571	-8.071068
Ireland [L=11,1,1,0]	-2.313274	-3.670955	0.328941	-2.994284	0.328941	-2.994284	-2.593968	-8.514108
Italy [L=2,1,4,0]	-0.489276	-3.985430	-0.711672	-7.969673	-0.573469	-1.371178	-2.002104	-6.822735
Luxembourg [L=-,1,3]	-	-	0.448031	-4.685325	-2.177796	-1.082947	-	-
Netherlands [L=0,1,0,4]	-1.703649	-12.01161	-0.780291	-3.080751	0.988687	-7.930361	-1.257628	-4.790359
Portugal [L=7,1,1,3]	-2.635630	-4.316302	-1.360597	-2.272307	-0.029844	-3.191755	-1.627263	-4.238683
Sweden [L=10,1,0,1]	-1.824340	-4.275567	-1.631369	-3.652369	-1.321748	-3.463197	-1.806112	-3.156776
UK [L=3,1,1,5]	-2.546826	-4.269087	-1.096863	-3.629133	-1.581112	-4.406320	-1.588627	-3.573922
EU average rates [L=10,1,1,6]	-2.104114	-3.746010	-1.619644	-2.051645	-0.573469	-3.363980	-0.827232	-3.141597

Notes a) The ADF tests were conducted in Eviews 6 and the ADF model with intercept is use. b) The selection of the lag length is based on the t-recursive method with the maximum lag order set at 12 for the 1991-2002 series and at 6 for the 2003-2008 series. c) The corresponding lag length is indicated next to each country. d) For the1991- 2002 data series, the 5% ADF critical value is -2.88 while for the 2003-2008 series, the 5% ADF critical value is -2.90 and the 10% ADF critical value is -2.59.

Table 5B.2: ADF unit root tests for the data series for the Household sector

Country	Consumer credit 1995-2002		Consumer credit (1yr) 2003-2008		Consumer credit (1-5yrs) 2003-2008	
	T-statistic for level	T-statistic for 1st difference	T-statistic for level	T-statistic for 1st difference	ADF t-statistic for level	ADF t-statistic for 1st difference
Austria [L=3,1,0]	-1.8921	-3.0213	-0.6641	-3.5447	-1.078604	-9.287907
Belgium [L=10,8,6]	-1.9540	-3.4466	-0.5785	-4.2316	-1.253345	-6.667670
Germany [L=1,0,6]	-3.7907	-5.0543	-2.3912	-9.7761	-1.891346	-3.035578
Denmark [L=-,3,1]	-	-	0.3891	-3.6007	-3.896467	-9.914475
Spain [L=2,7,3]	-2.0429	-5.0249	1.2511	-4.1755	0.780430	-4.433640
Finland [L=1,1,0]	-2.2994	-6.6807	-1.6585	-3.4639	-1.152477	-8.079956
France [L=5,1,5]	-2.0891	-3.1382	0.2195	-7.4476	-0.654875	-3.147188
Greece [L=-,2,0]	-	-	-2.0862	-5.3766	-1.852310	-8.309773
Ireland [L=-,0,1]	-	-	-1.6120	-8.0886	-2.136390	-4.792202
Italy [L=-,10,2]	-	-	-1.0039	-4.4421	-2.376508	-6.512411
Luxembourg [L=-,2,0]	-	-	1.1226	-5.3238	-2.753572	-8.227542
Netherlands [L=-,1,6]	-	-	-2.3821	-6.0066	-0.326200	-3.847909
Portugal [L=3,0,2]	-2.2781	-6.1848	-2.1393	-5.6905	-1.187695	-6.967640
Sweden [L=5,1,0]	-3.4123	-3.1008	-0.2354	-3.5401	-1.586274	-5.015856
UK [L=7,10,1]	-0.69995	-3.5464	0.3497	-5.005	0.772325	-6.109494
EU average rates [L=1,0,0]	-2.2892	-4.3291	-1.1647	-9.7068	-1.131770	-9.450420

Notes a) The ADF tests were conducted in Eviews 6 and the ADF model with intercept is use. b) The selection of the lag length is based on the t-recursive method. c) The corresponding lag length is indicated next to each country. d) For the1991- 2002 data series, the 5% ADF critical value is -2.88 while for the 2003-2008 series, the 5% ADF critical value is -2.90 and the 10% ADF critical value is -2.59.

Table 5B.3: ADF unit root tests for the data series for the Household sector

Country	Mortgage rates 1995-2002		Mortgages (1-5yrs) 2003-2008		Mortgages (5-10yrs) 2003-2008		Mortgages (>10yrs) 2003-2008	
	T-statistic for level	**T-statistic for 1st difference**	**T-statistic for level**	**T-statistic for 1st difference**	**ADF t-statistic for level**	**ADF t-statistic for 1st difference**	**ADF t-statistic for level**	**ADF t-statistic for 1st difference**
Austria [L=1,0,1,5]	-2.5570	-3.2560	-0.5616	-6.5187	-2.450634	-8.769648	-0.321532	-5.374796
Belgium [L=3,1,1,1]	-2.5804	-3.6939	-1.5455	-3.2074	-0.862872	-3.444731	-2.388138	-4.079191
Germany [L=1,4,1,4]	-2.3021	-5.2847	-1.1599	-3.8928	-2.053664	-4.047476	-1.691773	-3.656674
Denmark [L=-,3,3,3]	-	-	-0.6926	-3.7737	-0.880648	-3.524403	-0.632832	-3.610313
Spain [L=1,0,0,2]	-2.6513	-2.9182	0.1628	-6.5188	-1.104572	-7.578427	-0.147902	-2.934545
Finland [L=3,1,0,4]	-2.6463	-3.0761	-2.1346	-4.9464	-2.137331	-9.151715	-0.371307	-5.246873
France [L=3,3,5,1]	-2.0080	-3.0680	-0.4411	-3.0959	0.916685	-2.996113	-0.289718	-3.186010
Greece [L=-,0,2,0]	-	-	-1.2685	-8.8653	-2.409371	-3.398277	-2.144591	-9.743622
Ireland [L=1,0,0]	-1.2067	-5.6574	-1.0600	-3.8816	-0.752001	-2.980450	-	-
Italy [L=3,0,4,1]	-1.6052	-3.4750	-0.7878	-7.1114	-1.864918	-2.981668	-1.776827	-5.136526
Luxembourg [L=8,0,0]	-1.9756	-3.1131	-0.59998	-2.8890	-0.599986	-2.889039	-	-
Netherlands [L=6,1,1,1]	-2.2704	-3.4059	-1.10888	-4.0480	-1.235337	-4.014696	-0.889623	-3.596312
Portugal [L=1,6,6]	-1.7931	-3.4539	-1.0583	-3.7381	-1.058394	-3.738108	-	-
Sweden [L=3,4,5]	-2.7862	-3.0308	-1.5684	-3.2306	-1.779665	-2.626833	-	-
UK [L=12,1,1,1]	0.1272	-3.6118	-2.4684	-4.1249	-2.479169	-4.354763	-2.454898	-6.054605
EU average rates [L=2,0,2,1]	-1.7971	-3.2437	-0.4456	-3.1903	-1.830873	-3.081169	-1.260014	-3.826318

Notes a) The ADF tests were conducted in Eviews 6 and the ADF model with intercept is use. b) The selection of the lag length is based on the t-recursive method with the maximum lag order set at 12 for the 1991-2002 series and at 6 for the 2003-2008 series. c) The corresponding lag length is indicated next to each country. d) For the1991- 2002 data series, the 5% ADF critical value is -2.88 while for the 2003-2008 series, the 5% ADF critical value is -2.90 and the 10% ADF critical value is -2.59.

Appendix 5C

Table 5C.1: Johansen cointegration tests between each EU country's deposit rates and the corresponding European weighted average deposit rates

Country	Hypothesis	Deposit rates to households			
		Original (ST) 1991-2002	Original (1yr) 2003-2008	Original (1-2yrs) 2003-2008	Original (>2yrs) 2003-2008
Austria	**Trace test**				
	H_0: r=0	10.54177	7.171270	9.091012	10.74308
	H_1: r≤1	4.130261	1.996068	3.149242	3.176427
Lag order L_D=4,2,2,2	**Max. Eigen**				
	H_0: r=0	6.411509	5.175202	5.941770	7.566648
	H_1: r≤1	4.130261	1.996068	3.149242	3.176427
Belgium	**Trace test**				
	H_0: r=0	20.26787*	10.96773	24.21563*	19.77878
	H_1: r≤1	6.518696	3.464271	1.058796	3.339006
Lag order L_D=11,2,1,2	**Max. Eigen**				
	H_0: r=0	13.74917	7.503460	23.15683**	16.43977*
	H_1: r≤1	6.518696	3.464271	1.058796	3.339006
Germany	**Trace test**				
	H_0: r=0	25.50054**	13.91826	7.626401	13.70235
	H_1: r≤1	7.357530	3.353694	1.303740	0.930216
Lag order L_D=12,5,2,5	**Max. Eigen**				
	H_0: r=0	18.14301*	10.56457	6.322661	12.77213
	H_1: r≤1	7.357530	3.353694	1.303740	0.930216
Denmark	**Trace test**				
	H_0: r=0	13.50879	9.444398	13.71411	10.17132
	H_1: r≤1	4.272142	2.437665	2.305139	1.046972
Lag order L_D=5,4,2,2	**Max. Eigen**				
	H_0: r=0	9.236648	7.006732	11.40897	9.124348
	H_1: r≤1	4.272142	2.437665	2.305139	1.046972
Spain	**Trace test**				
	H_0: r=0	16.48954	14.19778	11.15727	23.59010*
	H_1: r≤1	5.383130	3.310195	1.845969	5.216624
Lag order L_D=4,4,2,6	**Max. Eigen**				
	H_0: r=0	11.10641	10.88758	9.311305	18.37347*
	H_1: r≤1	5.383130	3.310195	1.845969	5.216624

Table 5C.1 :Cont'd

Country	Hypothesis	Deposit rates to households			
		Original (ST) 1991-2002	Original (1yr) 2003-2008	Original (1-2yrs) 2003-2008	Original (>2yrs) 2003-2008
Finland	**Trace test**				
	H_0: r=0	12.47757	10.23518	24.14551*	16.16884
Lag order	H_1: r≤1	5.274026	2.614943	5.069032	4.837096
L_D=3,4,1,2					
	Max. Eigen				
	H_0: r=0	7.203548	7.620241	19.07647*	11.33175
	H_1: r≤1	5.274026	2.614943	5.069032	4.837096
	Trace test				
France	H_0: r=0	14.04607	12.15061	16.17230	11.82247
	H_1: r≤1	5.849257	2.264248	1.423028	2.517796
Lag order					
L_D=2,2,2,1	**Max. Eigen**				
	H_0: r=0	8.196812	9.886361	14.74927	9.304671
	H_1: r≤1	5.849257	2.264248	1.423028	2.517796
	Trace test				
Greece	H_0: r=0	24.35556*	13.31097	8.953319	10.75993
	H_1: r≤1	4.915198	4.563152	1.574403	2.906636
Lag order					
L_D=4,4,3,6	**Max. Eigen**				
	H_0: r=0	19.44036*	8.747816	7.378916	7.853290
	H_1: r≤1	4.915198	4.563152	1.574403	2.906636
	Trace test				
Ireland	H_0: r=0	19.77930	10.20105	15.32075	9.316572
	H_1: r≤1	6.234428	2.668661	3.752047	1.368956
Lag order					
L_D=11,4,1,1	**Max. Eigen**				
	H_0: r=0	13.54487	7.532385	11.56870	7.947616
	H_1: r≤1	6.234428	2.668661	3.752047	1.368956
	Trace test				
Italy	H_0: r=0	15.54077	15.01684	21.64235*	16.60538
	H_1: r≤1	4.504277	5.123770	2.611812	7.263171
Lag order					
L_D=7,5,3,2	**Max. Eigen**				
	H_0: r=0	11.03649	9.893073	19.03054*	9.342213
	H_1: r≤1	4.504277	5.123770	2.611812	7.263171

Table 5C.1: Cont'd

Country	Hypothesis	Deposit rates to households			
		Original (ST) 1991-2002	Original (1yr) 2003-2008	Original (1-2yrs) 2003-2008	Original (>2yrs) 2003-2008
Luxembourg	**Trace test**	-			-
	H_0: r=0	-	14.30247	14.69787	
Lag order	H_1: r≤1		3.211570	4.055126	
L_D=-,4,4					
	Max. Eigen				
	H_0: r=0	-	11.09090	10.64274	
	H_1: r≤1	-	3.211570	4.055126	
Netherlands	**Trace test**				
	H_0: r=0	11.24141	11.54106	10.95367	15.82356
Lag order	H_1: r≤1	3.523538	2.451251	1.218738	3.415460
L_D=2,2,3,6					
	Max. Eigen				
	H_0: r=0	7.717872	9.089810	9.734927	12.40810
	H_1: r≤1	3.523538	2.451251	1.218738	3.415460
	Trace test				
Portugal	H_0: r=0	26.96646**	11.05764	16.48107	12.76764
	H_1: r≤1	4.068042	2.881132	2.440319	2.516561
Lag order					
L_D=4,4,3,6	**Max. Eigen**				
	H_0: r=0	22.89842**	8.176513	14.04075	10.25108
	H_1: r≤1	4.068042	2.881132	2.440319	2.516561
	Trace test				
Sweden	H_0: r=0	24.04441*	20.89110*	11.73255	13.19026
	H_1: r≤1	4.561776	4.791531	3.714259	4.888905
Lag order					
L_D=11,5,2,2	**Max. Eigen**				
	H_0: r=0	19.48263*	16.09957*	8.018292	8.301356
	H_1: r≤1	4.561776	4.791531	3.714259	4.888905
	Trace test				
UK	H_0: r=0	20.81474*	14.35675	5.491380	11.79712
	H_1: r≤1	6.558507	4.006538	1.020748	1.286324
Lag order					
L_D=4,4,3,2	**Max. Eigen**				
	H_0: r=0	14.25624	10.35022	4.470633	10.51079
	H_1: r≤1	6.558507	4.006538	1.020748	1.286324

Table 5C.2: Johansen cointegration tests between each EU country's consumer credit rates and the corresponding European weighted average rates

Country	Hypothesis	Consumer credit rates		
		Original 1995-2002	Original (1yr) 2003-2008	Original (1-5 yrs) 2003-2008
Austria	**Trace test**			
	H_0: r=0	22.2043*	18.1401	30.78227**
	H_1: r≤1	8.6961	1.3551	8.558743
Lag order	**Max. Eigenvalue**			
L_C=2,2,6	H_0: r=0	13.5082	16.7850*	22.22353**
	H_1: r≤1	8. 6961	1.3551	8.558743
Belgium	**Trace test**			
	H_0: r=0	41.8785**	24.0904*	21.95701*
	H_1: r≤1	14.3663**	0.6649*	0.581172
Lag order	**Max. Eigenvalue**			
L_C=2,4,5	H_0: r=0	27.5122**	23.4255**	21.37584**
	H_1: r≤1	14.3663**	0.6649	0.581172
Germany	**Trace test**			
	H_0: r=0	21.9856*	11.9829	15.76229
	H_1: r≤1	8.7908	2.6477	1.406956
Lag order	**Max. Eigenvalue**			
L_C=5,1,1	H_0: r=0	13.1948	9.3352	14.35533
	H_1: r≤1	8.7908	2.6477	1.406956
Denmark	**Trace test**	-		
	H_0: r=0		20.8670*	30.11177**
	H_1: r≤1		2.3239	0.730998
Lag order	**Max. Eigenvalue**			
L_C=-,-,1,1	H_0: r=0		18.5431*	29.38077**
	H_1: r≤1		2.3239	0.730998
Spain	**Trace test**			
	H_0: r=0	15.4447	13.1937	12.72496
	H_1: r≤1	4.1707	1.6258	4.246865
Lag order	**Max. Eigenvalue**			
L_C=7,4,1	H_0: r=0	11.2740	11.5679	8.478099
	H_1: r≤1	4.1707	1.6258	4.246865

Table 5C.2:. Cont'd

Country	Hypothesis	Consumer credit rates		
		Original 1995-2002	Original (1yr) 2003-2008	Original (1-5 yrs) 2003-2008
Finland	**Trace test**			
	H_0: r=0	26.6144**	5.5002	16.82572
	H_1: r≤1	6.4986	0.9525	2.561260
Lag order L_C=2,2,1	**Max. Eigenvalue**			
	H_0: r=0	20.1159*	4.5477	14.26446
	H_1: r≤1	6.4986	0.9525	2.561260
France	**Trace test**			
	H_0: r=0	25.2001**	13.8479	23.86809*
	H_1: r≤1	6.4521	0.9440	0.531748
Lag order L_C=4,1,1	**Max. Eigenvalue**			
	H_0: r=0	18.7480*	12.9039	23.33634**
	H_1: r≤1	6.45210	0.94404	0.531748
Greece	**Trace test**	-		
	H_0: r=0		31.1663**	15.06186
	H_1: r≤1		11.5397*	1.806455
Lag order L_C=-,6,1	**Max. Eigenvalue**			
	H_0: r=0		19.6266	13.25540
	H_1: r≤1		11.5397	1.806455
Ireland	**Trace test**	-		
	H_0: r=0		20.1514	17.72633
	H_1: r≤1		1.34931	5.036402
Lag order L_C=-,1,2	**Max. Eigenvalue**			
	H_0: r=0		18.8021*	12.68993
	H_1: r≤1		1.3493	5.036402
Italy	**Trace test**	-		
	H_0: r=0		12.5956	13.00188
	H_1: r≤1		1.2156	1.078029
Lag order L_C=-,1,1	**Max. Eigenvalue**			
	H_0: r=0		11.3800	11.92385
	H_1: r≤1		1.2156	1.078029

Table 5C.2: Cont'd

Country	Hypothesis	Consumer credit rates		
		Original 1995-2002	Original (1yr) 2003-2008	Original (1-5 yrs) 2003-2008
Luxembourg	**Trace test**	-		
	H_0: r=0		21.6268*	18.29061
	H_1: r≤1		1.3461	0.429695
Lag order L_C=-,6,2	**Max. Eigenvalue**			
	H_0: r=0		20.2807**	17.86092*
	H_1: r≤1		1.3461	0.429695
Netherlands	**Trace test**	-		
	H_0: r=0		9.3395	28.02626**
	H_1: r≤1		1.3921	3.617242
Lag order L_C=-,1,5	**Max. Eigenvalue**			
	H_0: r=0		7.9474	24.40902**
	H_1: r≤1		1.3921	3.617242
Portugal	**Trace test**			
	H_0: r=0	15.2442	10.5975	20.25117
	H_1: r≤1	4.5251	1.6174	0.516173
Lag order L_C=2,1,1	**Max. Eigenvalue**			
	H_0: r=0	10.7191	8.9801	19.73499*
	H_1: r≤1	4.5251	1.6174	0.516173
Sweden	**Trace test**			
	H_0: r=0	24.7949*	10.0460	16.56046
	H_1: r≤1	3.8726	2.0979	6.240522
Lag order L_C=6,1,2	**Max. Eigenvalue**			
	H_0: r=0	20.9223**	7.9482	10.31993
	H_1: r≤1	3.8726	2.0979	6.240522
UK	**Trace test**			
	H_0: r=0	20.4118*	17.1819	10.34141
	H_1: r≤1	4.8713	5.9692	1.158277
Lag order L_C=2,3,1	**Max. Eigenvalue**			
	H_0: r=0	15.5405	11.2127	9.183134
	H_1: r≤1	4.8712	5.9692	1.158277

Table 5C.3: Johansen cointegration tests between each EU country's mortgage rates and the corresponding European weighted average mortgage rates

Country	Hypothesis	Mortgage rates to households			
		Original (2-5yrs) 1995-2002	Original (1-5yrs) 2003-2008	Original (5-10yrs) 2003-2008	Original (>10yrs) 2003-2008
Austria	**Trace test**				
	H_0: r=0	25.1792**	12.5925	23.44518*	10.68294
Lag order	H_1: r≤1	9.3778*	2.3408	2.941560	2.635558
L_M=5,2,2,2	**Max. Eigen**				
	H_0: r=0	15.8015	10.2518	20.50362**	8.047382
	H_1: r≤1	9.37778	2.3408	2.941560	2.635558
Belgium	**Trace test**				
	H_0: r=0	26.2812**	6.9774	7.861072	16.91577
Lag order	H_1: r≤1	6.4408	1.3074	0.856934	1.787602
L_M=3,3,3,2	**Max. Eigen**				
	H_0: r=0	19.84039*	5.6700	7.004138	15.12817
	H_1: r≤1	6.44080	1.3074	0.856934	1.787602
Germany	**Trace test**				
	H_0: r=0	47.4547**	24.7868*	7.573050	10.94586
Lag order	H_1: r≤1	6.1140	5.7786	1.653979	3.106277
L_M=2,5,2,3	**Max. Eigen**				
	H_0: r=0	41.3407**	19.0081*	5.919071	7.839582
	H_1: r≤1	6.1140	5.7786	1.653979	3.106277
Denmark	**Trace test**	-			
	H_0: r=0		5.2692	6.173059	4.285493
Lag order	H_1: r≤1		1.0099	1.154260	0.845763
L_M=-,2,3,4	**Max. Eigen**				
	H_0: r=0		4.2593	5.018800	3.439730
	H_1: r≤1		1.0099	1.154260	0.845763
Spain	**Trace test**				
	H_0: r=0	14.120661	9.8668	7.593938	13.33155
Lag order	H_1: r≤1	5.6491	2.9163	3.073306	1.548311
L_M=2,2,3,4	**Max. Eigen**				
	H_0: r=0	8.47151	6.9504	4.520633	11.78323
	H_1: r≤1	5.64915	2.9163	3.073306	1.548311

Table 5C.3: Cont'd

Country	Hypothesis	Mortgage rates to households			
		Original (2-5yrs) 1995-2002	Original (1-5yrs) 2003-2008	Original (5-10yrs) 2003-2008	Original (>10yrs) 2003-2008
Finland	**Trace test**				
	H_0: r=0	22.8451*	21.9182*	28.37448**	17.09186
Lag order	H_1: r≤1	8.5636	2.9863	4.145932	2.395333
L_M=4,2,1,5					
	Max. Eigen				
	H_0: r=0	14.2815	18.9319*	24.22854**	14.69653
	H_1: r≤1	8.56360	2.9863	4.145932	2.395333
France	**Trace test**				
	H_0: r=0	21.8088*	29.1493**	6.869825	7.352684
	H_1: r≤1	5.5213	4.01641	0.680406	2.067020
Lag order					
L_M=6,2,3,4	**Max. Eigen**				
	H_0: r=0	16.2875*	25.1329**	6.189420	5.285664
	H_1: r≤1	5.52132	4.0164	0.680406	2.067020
Greece	**Trace test**	-			
	H_0: r=0		14.4600	14.55059	6.361103
	H_1: r≤1		4.1745	5.952087	1.507368
Lag order					
L_M=-,2,2	**Max. Eigen**				
2	H_0: r=0		10.2854	8.598505	4.853735
	H_1: r≤1		4.1745	5.952087	1.507368
Ireland	**Trace test**				-
	H_0: r=0	16.0075	15.0081	18.11032	
	H_1: r≤1	4.0534	5.9459	8.341963	
Lag order					
L_M=2,2,3,2	**Max. Eigen**				
	H_0: r=0	11.9542	9.0623	9.768359	
	H_1: r≤1	4.0534	5.9459	8.341963	
Italy	**Trace test**				
	H_0: r=0	30.47787**	15.9799	12.70549	16.83278
	H_1: r≤1	7.1084	2.5744	5.382852	2.633300
Lag order					
L_M=2,2,2,1	**Max. Eigen**				
	H_0: r=0	23.3695**	13.4055	7.322633	14.19948
	H_1: r≤1	7.10836	2.5744	5.382852	2.633300

Table 5C.3: Cont'd

Country	Hypothesis	Mortgage rates to households			
		Original (2-5yrs) 1995-2002	Original (1-5yrs) 2003-2008	Original (5-10yrs) 2003-2008	Original (>10yrs) 2003-2008
Luxembourg	**Trace test**				-
	H_0: r=0	20.3179*	19.9130	13.98703	
Lag order	H_1: r≤1	7.6450	4.3521	5.824805	
L_M=6,2,3,-	**Max. Eigen**				
	H_0: r=0	12.6729	15.5608	8.162230	
	H_1: r≤1	7.64500	4.3521	5.824805	
Netherlands	**Trace test**				
	H_0: r=0	30.7564**	11.1795	7.293172	14.92258
Lag order	H_1: r≤1	7.3868	3.3947	3.336571	3.574487
L_M=3,3,3,2	**Max. Eigen**				
	H_0: r=0	23.3696**	7.7848	3.956601	11.34809
	H_1: r≤1	7.3868	3.3947	3.336571	3.574487
Portugal	**Trace test**				-
	H_0: r=0	15.7519	8.7309	13.01543	
Lag order	H_1: r≤1	6.0196	2.1055	4.656313	
L_M=2,2,3,-	**Max. Eigen**				
	H_0: r=0	9.7324	6.6253	8.359112	
	H_1: r≤1	6.0196	2.1055	4.656313	
Sweden	**Trace test**				-
	H_0: r=0	18.0836	10.355	9.349774	
Lag order	H_1: r≤1	7.04556	3.8556	2.705272	
L_M=4,2,2,-	**Max. Eigen**				
	H_0: r=0	11.0381	6.4991	6.644502	
	H_1: r≤1	7.04556	3.8556	2.705272	
UK	**Trace test**				
	H_0: r=0	8.7187	6.7474	11.37746	15.68559
Lag order	H_1: r≤1	2.6132	1.918	2.219768	5.962328
L_M=2,3,2,4	**Max. Eigen**				
	H_0: r=0	6.1054	4.8297	9.157694	9.723258
	H_1: r≤1	2.6132	1.9177	2.219768	5.962328

Notes:
** Indicates rejection at the 5% level*
** Indicates rejection at the 1% level

1. For the trace rank test :

At H_0 (r=0), the 5% critical value is 20.26 and the 1% critical value is 25.08
At H_0 (r≤1), the 5% critical value is 9.16 and the 1% critical value is 12.76

2. For the maximum eigenvalue rank test,

At H_0 (r=0), the 5% critical value is 15.89 and the 1% critical value is 20.16
At H_0 (r≤1), the 5% critical value is 9.16 and the 1% critical value is 12.76

3. The statistics are based on a Johansen VAR model with an intercept in the cointegrating equation and have been conducted in Eviews 6.

4. The lag orders of the VARs have been obtained by using the Akaike Information Criterion and run in Eviews 6;

5. The lag order selected for each VAR model is listed under L_D for the4 types of deposit rates, under L_C for the 3 types of consumer credit rates data and under L_M for the four types of households' mortgage rates data. These follow the same order as listed in the table.

Appendix 5D

Table 5D.1: Bai and Perron statistics for tests of multiple structural breaks in the household short term deposit spreads[79] [1991-2002]

Country	Udmax[80]	WD max (5%)[81]	F(1/0)[82]	F(2/1)[83]	F(3/2)[84]	F(4/3)[85]	F(5/4)[86]
Austria	416.1071***	913.0943**	49.3047***	47.7809***	30.5313***	30.5313***	0.0000
Belgium	91.5542***	200.9041**	27.0997***	9.7229*	16.4180***	10.0832*	0.0000
Germany	637.1399***	1398.1228**	89.9114***	23.6263***	69.1245***	0.0867	0.0000
Denmark	40.2021***	84.5510**	13.7204***	19.8217***	33.4708***	31.0125***	0.0000
Spain	336.20***	578.0894**	113.08***	15.4435***	10.4864*	10.4864*	0.0000
Finland	991.448***	991.448**	991.448***	2.8646	16.1990***	0.3161	0.0157
France	405.5992***	647.1626**	121.208***	44.6086***	16.9757***	2.0995	1.6953
Greece	521.82***	1145.07**	101.101***	321.43***	56.44***	19.52***	0.0000
Ireland	235.69***	405.25**	9.7356**	19.6897***	57.8088***	9.1920	9.1920
Italy	436.6171***	750.7365**	12.8923***	152.57***	5.9503	5.2977	9.1122
Netherlands	1446.95***	1719.51**	1018.84***	202.15***	7.6469	3.0246	0.0000
Portugal	311.65***	535.86**	24.798***	88.28***	2.5556	9.9008	0.0000
Sweden	237.8283***	521.8841**	48.3413***	22.3455***	6.0832	39.3809***	1.7371
UK	181.6452***	398.5974**	30.2038***	35.6854***	55.8485***	30.2962***	15.182**

Table 5D.2: Bai and Perron statistics for tests of multiple structural breaks in the household deposit spreads with 1 yr maturity [2003-2008]

Country	UDmax	WDmax (5%)	F(1/0)	F(2/1)	F(3/2)
Austria	59.8089***	76.3070**	15.9862***	82.9126***	9.6323*
Belgium	23.3487***	31.5568**	9.3528**	40.8039***	17.7333***
Germany	155.3572***	184.6211**	14.8573***	124.706***	4.6537
Denmark	75.8374***	109.1754**	15.4820***	32.3855***	43.9686***
Spain	174.0276***	250.5297**	70.6722***	14.1342***	23.0157***
Finland	850.9291***	1224.99**	58.7057***	64.6533***	15.2442**
France	36.1179***	42.9213**	34.4330***	11.3848**	4.7697
Greece	32.4979***	46.7838**	14.1985***	39.0008***	12.5111**
Ireland	98.8048***	117.4162**	15.8136***	108.229***	29.3975***
Italy	126.3687***	181.92**	41.5189***	111.838***	15.3619***
Netherlands	83.2781***	83.2781**	83.2781***	1.1387	4.5676
Portugal	72.2639***	104.0309**	17.2139***	56.4062***	15.4180***
Sweden	61.9527***	83.2691**	24.4705***	14.2351***	7.5086
UK	202.5814***	211.7249**	202.581***	42.8605***	28.0415***
Luxembourg	61.2225***	72.7547**	23.4344***	12.8385**	1.2554

79 The deposit spread is the difference between the deposit rate and the European weighted average
80 10, 5 and 1 per cent critical values are 7.46, 8.88 and 12.37, respectively.
81 Critical value is 9.91.
82 10, 5 and 1 per cent critical values are 7.04, 8.58 and 12.29, respectively.
83 10, 5 and 1 per cent critical values are 8.51, 10.13 and 13.89, respectively.
84 10, 5 and 1 per cent critical values are 9.41, 11.14 and 14.80, respectively.
85 10, 5 and 1 per cent critical values are 10.04, 11.83 and 15.28, respectively.
86 10, 5 and 1 per cent critical values are respectively 10.58, 12.25 and 15.76, respectively.
***significant at the 1% level; ** significant at the 5% level; *significant at the 10% level.
The Bai and Perron (1998) test statistics have been computed using Perron's GAUSS code (available on his home page:http://econ.bu.edu/perron/ and were run in OxEdit.

Table 5D.3:.Bai and Perron statistics for tests of multiple structural breaks in the household deposit spreads with 1-2 years' maturity [2003-2008]

Country	UDmax[87]	WDmax (5%)[88]	F(1/0)[89]	F(2/1)[90]	F(3/2)[91]
Austria	22.7465***	27.0311**	12.1138**	21.8664**	3.0814
Belgium	9.6411**	11.4571**	5.9385	1.0800	3.8834
Germany	88.4274***	127.2998**	67.4055***	14.7464***	13.1247**
Denmark	75.3470***	89.5398**	70.8105***	14.5346***	7.4003
Spain	120.6837***	143.416**	111.274***	12.3682**	2.2963
Finland	332.4908***	395.1207**	157.395***	17.0126***	5.8795
France	20.9269***	20.9269**	20.9269***	5.0472	2.9300
Greece	24.4317***	35.1718**	2.3923	19.2024***	5.7821
Ireland	106.2875***	153.0111**	31.3792***	54.2233***	11.1782**
Italy	198.8747***	286.2994**	36.9220***	67.0249***	18.8264***
Netherlands	47.4897***	68.1884**	10.1729**	15.4457***	27.1262***
Portugal	60.8038***	66.8030**	60.8038***	20.6535***	14.4479**
Sweden	77.4509***	111.4981**	9.1651**	72.3800***	7.1813
UK	92.5477***	109.9805**	4.1999	66.9988***	7.6632
Luxembourg	29.7625***	42.8460**	25.5889***	14.7460***	13.0343**

Table 5D.4: .Bai and Perron statistics for tests of multiple structural breaks in the household deposit spreads with over 2 years' maturity [2003-2008]

Country	UDmax	WDmax (5%)	F(1/0)	F(2/1)	F(3/2)
Austria	84.9028***	122.2259**	38.2453***	42.8189***	37.0870***
Belgium	59.3787***	70.5637**	56.4139***	9.6204*	8.4722
Germany	6.8376	9.8434	1.9172	5.8901	4.0837
Denmark	99.3006***	142.9529**	79.4460***	13.5316**	12.2630**
Spain	41.1104***	55.6797**	18.3360***	40.3374***	8.4713
Finland	37.7949***	54.4095**	26.8321***	7.1697	16.0852***
France	77.9082***	77.9082**	77.9082***	11.6147**	7.1409
Greece	39.2061***	55.2754**	39.2061***	7.5709	17.6996***
Ireland	103.0316***	122.4392**	24.2629***	27.0416***	16.1132***
Italy	411.4125***	488.9085**	56.0023***	70.3046***	5.6228
Netherlands	31.5181***	33.4277**	31.5181***	11.6949**	6.5642
Portugal	5.7128	6.8029	5.7128	2.4257	6.0863
Sweden	135.7611***	195.4413**	16.2072***	24.6313***	42.9125***
UK	73.1320***	73.1320**	73.1320***	1.5201	13.8970**

[87] 10, 5 and 1 per cent critical values are 7.46, 8.88 and 12.37, respectively.
[88] Critical value is 9.91.
[89] 10, 5 and 1 per cent critical values are 7.04, 8.58 and 12.29, respectively.
[90] 10, 5 and 1 per cent critical values are 8.51, 10.13 and 13.89, respectively.
[91] 10, 5 and 1 per cent critical values are 10.04, 11.83 and 15.28, respectively.

Table 5D.5:.Bai and Perron statistics for tests of multiple structural breaks in the consumer credit spreads [1995-2002]

Country	UDmax[92]	WDmax (5%)[93]	F(1/0)[94]	F(2/1)[95]	F(3/2)[96]
Austria	91.1008***	108.2610**	33.9489***	41.7132***	8.2183
Belgium	128.2646***	184.6493**	17.9338***	1.5377	77.4940***
Germany	295.8***	323.72**	295.83***	62.1288***	123.789***
Spain	184.5857***	262.8049**	129.174***	1.7763	15.4287***
Finland	56.6136***	76.9760**	32.6094***	17.1744***	8.0180
France	86.8040***	103.1549**	20.2002***	15.1724***	5.9731
Portugal	77.951***	112.2183**	68.4419***	10.9115**	48.8734***
Sweden	579.803***	689.018**	334.184***	14.21***	8.1088
UK	57.7174***	83.0899**	35.9765***	29.5747***	8.4239

Table 5D.6:.Bai and Perron statistics for tests of multiple structural breaks in the consumer credit spreads with 1 year maturity [2003-2008]

Country	UDmax	WDmax (5%)	F(1/0)	F(2/1)	F(3/2)
Austria	97.2687***	97.2687**	97.2687***	9.4883*	4.7959
Belgium	36.9432***	36.9432**	36.9432***	5.8507	5.6500
Germany	19.0578***	27.4355**	18.7537***	3.4941	18.5800***
Denmark	12.9736***	13.3007**	12.9736***	3.5097	1.4269
Spain	60.8001***	72.2528**	36.443***	17.9469***	5.6319
Finland	32.3919***	38.4934**	3.5547	32.957***	5.3179
France	105.7196***	147.8700**	65.5189***	24.9714***	3.1947
Greece	132.3786***	190.5719**	28.4501***	23.2171**	35.2142***
Ireland	22.1591***	29.3015**	17.9114***	17.4595***	7.7284
Italy	24.9628***	35.9363**	13.7707***	8.8184*	1.6395
Netherlands	8.7773*	8.8086	8.7773**	6.5728	2.9445
Portugal	51.1072***	60.7341**	36.8798***	42.5332***	7.4023
Sweden	39.5948***	47.5399**	39.5948***	7.1133	52.4931***
UK	101.9625***	118.0349**	101.963***	30.2768***	5.8661
Luxembourg	17.9609***	22.7755**	17.9609***	4.4674	10.3271*

[92] 10, 5 and 1 per cent critical values are 7.46, 8.88 and 12.37, respectively.
[93] Critical value is 9.91.
[94] 10, 5 and 1 per cent critical values are 7.04, 8.58 and 12.29, respectively.
[95] 10, 5 and 1 per cent critical values are 8.51, 10.13 and 13.89, respectively.
[96] 10, 5 and 1 per cent critical values are 9.41, 11.14 and 14.80, respectively.

Table 5D.7: Bai and Perron statistics for tests of multiple structural breaks in the consumer credit spreads with 1-5 years' maturity [2003-2008]

Country	UDmax	WDmax (5%)	F(1/0)	F(2/1)	F(3/2)
Austria	86.9352***	125.1517**	67.9350***	9.4544*	3.5573
Belgium	10.9657**	13.0312**	6.1913	12.7822**	6.6425
Germany	137.6147***	163.5366**	37.9930***	37.0595***	3.3753
Denmark	3.7681	4.2375	3.7681	3.2218	1.3703
Spain	201.6145***	290.2437**	93.9124***	15.5445***	26.9696***
Finland	80.8621***	116.4089**	33.953***	11.7503**	10.0219*
France	10.0607**	14.4834**	9.8067**	5.7237	9.6858*
Greece	64.4982***	76.6474**	44.3943***	22.5925***	5.6915
Ireland	42.7828***	61.5900**	3.1144	55.6721***	41.6635***
Italy	116.6475***	138.6198**	67.7968***	17.1745***	2.5880
Netherlands	68.8297***	99.0870**	45.2034***	11.0585**	11.0585*
Portugal	41.6786***	60.0004**	25.4629***	13.6574**	13.6574**
Sweden	46.0532***	66.1756**	6.5338	39.2244***	6.2649
UK	98.6573***	142.0268**	34.1642***	28.3684***	22.0007***
Luxembourg	16.6204***	19.7511**	13.7197***	9.9228*	3.5264

Table 5D.8: Bai and Perron statistics for tests of multiple structural breaks in the household mortgage spreads [1995-2002]

Country	UDmax[97]	WDmax (5%)[98]	F(1/0)[99]	F(2/1)[100]	F(3/2)[101]	F(4/3)[102]	F(5/4)[103]
Austria	431.93***	742.68**	71.937***	40.3723***	34.1275***	3.1340	0.4374
Belgium	287.149***	362.3860**	83.70***	42.5413***	8.7775	11.06*	0.5530
Germany	1639.11***	3596.82**	341.29***	41.715***	21.9678***	4.9667	0.0000
Spain	779.70***	779.70**	779.70***	3.1387	13.6441**	47.873***	7.9027
Finland	397.602***	872.487**	28.504***	101.52***	10.53*	54.95***	5.0654
France	19.487***	25.6903**	19.487***	2.8165	7.0422	5.6449	5.6449
Ireland	236.56***	519.10**	26.760***	24.3105***	13.0037***	46.321***	0.4069
Italy	540.94***	1187.02**	204.65***	63.797***	6.0624	15.897***	0.0000
Netherlands	191.17***	303.89**	108.93***	62.57***	25.27***	3.3104	23.839***
Portugal	992.02***	1428.11**	180.94***	8.441	18.861***	3.2428	18.861***
Sweden	88.05***	171.56**	49.825***	32.27***	8.5238	91.423***	0.8393
UK	105.587***	167.41**	49.821***	13.1601**	77.5637***	0.5046	0.2488
Luxembourg	498.51***	592.42**	294.54***	14.0937***	5.1859	20.393***	20.393***

[97] 10, 5 and 1 per cent critical values are 7.46, 8.88 and 12.37, respectively.
[98] Critical value is 9.91.
[99] 10, 5 and 1 per cent critical values are 7.04, 8.58 and 12.29, respectively.
[100] 10, 5 and 1 per cent critical values are 8.51, 10.13 and 13.89, respectively.
[101] 10, 5 and 1 per cent critical values are 9.41, 11.14 and 14.80, respectively.
[102] 10, 5 and 1 per cent critical values are 10.04, 11.83 and 15.28, respectively.
[103] 10, 5 and 1 per cent critical values are respectively 10.58, 12.25 and 15.76, respectively.
***significant at the 1% level; ** significant at the 5% level; *significant at the 10% level.
The Bai and Perron (1998) test statistics have been computed using Perron's GAUSS code (available on his home page:http://econ.bu.edu/perron/ and were run in OxEdit.

Table 5D.9:.Bai and Perron statistics for tests of multiple structural breaks in the mortgage spreads with 1-5 years' maturity [2003-2008]

Country	UDmax[104]	WDmax [105](5%)	F(1/0)[106]	F(2/1)[107]	F(3/2)[108]
Austria	165.06***	189.05**	165.06***	10.17**	9.57*
Belgium	24.39***	24.39**	24.39***	8.4341	8.6685
Germany	235.84***	339.51**	94.11***	2.3342	34.6064***
Denmark	68.5362***	98.6645**	61.6638***	26.9062***	4.6642
Spain	87.1353***	125.4397**	35.7795***	27.6322***	29.2835***
Finland	38.5949***	55.5611**	5.8960	30.6378***	1.4639
France	185.44***	220.37**	16.4476***	224.90***	14.62**
Greece	142.28***	204.82**	125.39***	26.27***	30.98***
Ireland	45.1873***	53.6991**	4.7672	48.6097***	5.2118
Italy	142.10***	142.10**	142.10***	7.9672	3.1898
Netherlands	15.6987***	22.5998**	2.1925	30.0665***	16.9471***
Portugal	140.0963***	201.6822**	38.3852***	161.16***	56.981***
Sweden	74.9374***	107.8797**	62.7169***	28.8517***	7.7929
UK	26.9869***	38.8503**	26.7695**8	20.2458***	10.2090*
Luxembourg	46.6295***	55.4129**	16.3032***	46.0983***	1.8505

Table 5D.10:.Bai and Perron statistics for tests of multiple structural breaks in the mortgage spreads with 5-10 years' maturity [2003-2008]

Country	UDmax	WDmax (5%)	F(1/0)	F(2/1)	F(3/2)
Austria	48.2624***	48.2624**	48.2624***	3.7107	8.1816
Belgium	58.1306***	69.0804**	52.5569***	73.7471***	2.4789
Germany	87.7422***	126.3135**	24.4092***	49.2623***	35.0288***
Denmark	34.8026***	50.1017**	22.3580***	14.3020***	17.0416***
Spain	69.0617***	82.0705**	42.0051***	9.1503*	19.4097***
Finland	25.0384***	36.0452**	16.4137***	13.4776**	8.6882
France	68.3846***	98.4463**	18.2821***	71.9284***	6.2024
Greece	218.58***	264.10**	114.971***	121.91***	12.37**
Ireland	181.38**	261.12**	166.835***	11.65**	195.46***
Italy	33.0012***	39.2175**	5.1757	36.3773***	16.4993***
Netherlands	71.2439***	71.2439**	71.2439***	4.4594	4.3994
Portugal	879.586***	1266.25**	207.131***	83.30***	1577.10***
Sweden	152.33***	219.30**	65.868***	71.75**	28.51***
UK	58.75***	58.75**	58.75***	11.15**	12.55**
Luxembourg	346.13***	498.28**	99.76***	18.7512***	71.1273***

[104] 10, 5 and 1 per cent critical values are 7.46, 8.88 and 12.37, respectively
[105] Critical value is 9.91
[106] 10, 5 and 1 per cent critical values are 7.04, 8.58 and 12.29, respectively.
[107] 10, 5 and 1 per cent critical values are 8.51, 10.13 and 13.89, respectively.
[108] 10, 5 and 1 per cent critical values are 9.41, 11.14 and 14.80, respectively.

Table 5D.11:.Bai and Perron statistics for tests of multiple structural breaks in the mortgage spreads with over 10 years' maturity [2003-2008]

Country	UDmax[109]	WDmax[110] (5%)	F(1/0)[111]	F(2/1)[112]	F(3/2)[113]
Austria	27.5620***	27.5620**	27.5620***	7.8613	1.0392
Belgium	20.6485***	24.5380**	14.1165***	9.5839*	4.9736
Germany	105.6794***	152.1357**	47.9321***	40.2025***	26.1425***
Denmark	22.9199***	32.9954**	12.118**	10.5043**	21.4360***
Spain	166.856***	166.856**	166.856***	28.7685***	23.0555***
Finland	62.3008***	78.2631**	62.3008***	7.4258	24.50***
France	38.7504***	55.7850**	11.9725**	12.1134**	9.0886
Greece	192.73***	197.41**	192.73***	13.265**	2.2974
Italy	23.8502***	34.3347**	14.4636***	3.5352	4.6221
Netherlands	61.9653***	68.0654**	61.9653***	11.2308**	5.6576
UK	34.8963***	41.4696**	18.4167***	21.6648***	6.7527

[109] 10, 5 and 1 per cent critical values are 7.46, 8.88 and 12.37, respectively
[110] Critical value is 9.91
[111] 10, 5 and 1 per cent critical values are 7.04, 8.58 and 12.29, respectively.
[112] 10, 5 and 1 per cent critical values are 8.51, 10.13 and 13.89, respectively.
[113] 10, 5 and 1 per cent critical values are 9.41, 11.14 and 14.80, respectively.

Appendix 5E

Table 5E.1: Structural break dates for the deposit and consumer credit spreads to the household sector for the period 1991-2008

Country	ST deposit rates 1991-2002	Deposit rates (1 yr) 2003-2008	Deposit rates (1-2 yrs) 2003 -2008	Deposit rates (> 2 yrs) 2003-2008	Consumer credit 1995-2002	Consumer credit (1 yr) 2003-2008	Consumer credit (1-5 yrs) 2003-2008
Austria	Jun 93, Feb 96, Nov 97, Sept 00	Jan 04, Feb 06	Nov 05, Feb 08	Nov 04, Feb 06, Jan 07	Jul 97, Feb 00	Oct 06	Jun 06
Belgium	Dec 92, Sept 94, Aug 99	Dec 03, Jul 05, May 06	Mar 06	Jan 07	Apr 96, Sept 97, Jun 99	Aug 07	Jun 05, Nov 07
Germany	May 94, Oct 98, Jul 00	Dec 03, Jun 06	Jan 04, Aug 05, Apr 07	Apr 05	Aug 97, Nov 98, May 01	Apr 05, May 06, Nov 07	Mar 06, Sept 07
Denmark	Oct 93, Oct 95, May 98, Mar 00	Dec 03, Feb 06, Jan 07	Mar 06, Jan 07	Jul 05, Nov 06, Jan 08	-	Oct 03	Nov 05
Spain	Sept 93, Dec 96	Dec 03, Nov 05, Sept 07	Dec 05, Sept 07	Oct 03, Dec 05	Nov 96, Dec 97, Dec 99	Jul 06, Dec 07	Jun 04, Apr 05, Mar 06
Finland	Mar 93, Aug 98, May 00	Dec 03, Feb 06, Apr 07	Dec 05, Dec 06	Nov 05, Jan 07, Jan 08	Sept 99, Aug 01	Feb 05, Nov 06	Jan 04, May 06
France	May 93, Oct 96, Mar 01	Dec 03, May 06	Jun 07	Oct 03, Feb 07	Apr 96, Nov 00	Aug 06, Sep 07	Feb 08
Greece	Oct 92, Apr 95, Jan 97, Jun 00	Dec 03, Sep 06, Feb 08	Jun 04, Apr 05	Nov 04, Jun 06, Sept 07	-	Nov 03, Nov 04, Jun 06	Oct 04, Jul 07
Ireland	Feb 93, Aug 96, Nov 98	Dec 03, Dec 05, Oct 06	Jun 05, Jul 06, Aug 07	Nov 03, Jan 05, Apr 07	-	Oct 03, Nov 06	Dec 03, Feb 06, Dec 07
Italy	Sept 92, Mar 98	Feb 04, Dec 04, Jul 06	Nov 03, Mar 06, Jan 07	Jun 06, Jun 07	-	Nov 06	Feb 04, Feb 07
Netherlands	Nov 93, Nov 98	Dec 03	Nov 04, Nov 05, Oct 06	Oct 03, Feb 08	-	Jan 08	Feb 05, Jan 06
Luxembourg	-	Dec 03, Mar 05	Oct 03, Jun 05, Nov 06	-	-	Dec 06	Apr 05
Portugal	Jul 95, Apr 97	Jan 04, Sept 06, Sept 07	Mar 06, Jan 07, Nov 07	Dec 07	Mar 97, Apr 98, Nov 00	Dec 03, Jun 06	Dec 03, Sept 06, Nov 07
Sweden	Dec 92, Sep 94, Jun 96, Mar 01	Feb 04, Nov 06	Jan 04, May 07	Mar 04, Mar 06, Apr 07	Jun 96, Aug 98	Mar 04, Apr 05, Dec 07	Apr 04, Jun 06
UK	Sep 92, Jun 94, May 97, Feb 99, Feb 01	Dec 03, May 06, Feb 08	May 04, Aug 05	May 04, May 05, Jul 06	Jul 00, Sept 01	Jun 06, Nov 07	Mar 04, Feb 06, Aug 07

Table 5E.2: Structural break dates for mortgage spreads for the household sector for the period 1995-2008

Country	Mortgage rates 1995-2002	Mortgage rates (1-5 yrs) 2003-2008	Mortgage rates (5-10 yrs) 2003-2008	Mortgage rates (>10 yrs) 2003-2008
Austria	Oct 96, Feb 98, Sept 00	Feb 04, Dec 07	Jun 07	May 04
Belgium	Sept 97, Nov 98	Apr 04	Oct 03, Aug 07	Apr 05
Germany	May 96, Aug 97, May 99	Oct 05, Nov 06, Sept 07	May 05, Aug 06, Sept 07	Aug 04, Aug 06, Sept 07
Denmark	-	Jul 04, Oct 05	Jan 04, Jan 06, Feb 08	Dec 04, Feb 06, Feb 08
Spain	Apr 96, May 97, Jun 00, Nov 01	Dec 04, Sept 06, Jul 07	Jan 04, Dec 06, Feb 08	Mar 04, May 05, Oct 06
Finland	Apr 96, Sept 97, Feb 00, Aug 01	Sept 05, Sept 07	Oct 05, Dec 07	Dec 03, Oct 04, Sept 05
France	Nov 00	Oct 03, Nov 05, Jan 08	Nov 03, Oct 07	May 04, Nov 07
Greece		Jun 04, Feb 06, Feb 07	Oct 03, Feb 06, Dec 06	May 06, Apr 07
Ireland	Apr 97, Aug 99, Sep 00, Oct 01	Oct 03, May 05	Oct 03, Mar 05, Sept 06	-
Italy	Nov 96, Feb 98, Mar 99, Dec 00	Dec 07	Oct 03, Aug 04, May 06	Mar 05
Netherlands	Mar 97, May 98, Jun 99, Oct 00, Nov 01	May 04, Feb 06, Dec 06	Mar 04	May 04, Jul 05
Luxembourg	Oct 96, Jan 98, Jul 99, Oct 00, Nov 01	Oct 03, Jun 05	Oct 03, Mar 05, Sept 06	-
Portugal	May 96, Sept 97, Feb 99, Jun 00, Sept 01	Oct 03, Nov 04, Mar 06	Oct 03, Mar 05, Oct 06	-
Sweden	May 96, Sept 98, Jul 00, Nov 01	Jan 04, Feb 08	Jan 04, Dec 04, Feb 08	-
UK	Nov 96, Dec 97, Aug 00	Oct 03, Dec 07	Oct 03, Dec 06, Dec 07	Oct 03, Jan 06

Appendix 5F

Table 5F.1: Im, Pesaran and Shin (IPS) (2003) panel unit root test on spreads

Panel data	IPS panel unit root test statistics
Deposit spreads	
• 1991-2002 panel set	-2.04735**
• 1991-2002 demeaned panel set	-10.6229***
• 2003-2008 (1yr)panel set	1.87376
• 2003-2008 (1yr) demeaned panel set	-2.01405**
• 2003-2008 (1-2yrs)panel set	-0.31265
• 2003-2008 (1-2yrs) demeaned panel set	-5.30246***
• 2003-2008 (>2 yrs) panel set	-0.73118
• 2003-2008 (>2 yrs) demeaned panel set	-7.78527***
Consumer credit spreads	
• 1995-2002 panel set	0.19646
• 1995-2002 demeaned panel set	-5.15635***
• 2003-2008 (1yr) panel set	2.72304
• 2003-2008 (1yr) demeaned panel set	-9.59518***
• 2003-2008 (1-5yrs) panel set	-1.51221
• 2003-2008 (1-5yrs) demeaned panel set	-8.59061***
Mortgage spreads	
• 1995-2002 (2-5yrs) panel set	-0.78180
• 1995-2002 (2-5yrs) demeaned panel set	-11.6728***
• 2003-2008 (1-5yrs) panel set	0.85811
• 2003-2008 (1-5yrs) demeaned panel set	-5.08065***
• 2003-2008 (5-10yrs) panel set	-0.11149
• 2003-2008 (5-10yrs) demeaned panel set	-5.83323***
• 2003-2008 (>10yrs) panel set	-0.04756
• 2003-2008 (>10yrs) demeaned panel set	-4.99961***

Note:

1) The critical values (one-tailed normal distribution) at 1% and 5% and 10% are -2.3263, -1.6449 and -1.2816 respectively.
2) The lag for each individual series is selected based on the modified Akaike criterion.
3) The model used is one with individual intercept and no trend
3) The IPS unit root tests are conducted in Eviews 6.0
*** indicates significance at the 1% level, ** significant at 5%, * significant at 10%.

Appendix 5G

Table 5G.1: CD tests on the deposit and lending spreads

Panel data	Cross section dependence (CD) test statistics
Deposit spreads	
• 1991-2002 panel set	-3.50***
• 1991-2002 demeaned panel set	-0.14
• 2003-2008 (1yr)panel set	-0.61
• 2003-2008 (1yr) demeaned panel set	-2.07**
• 2003-2008 (1-2yrs)panel set	2.57**
• 2003-2008 (1-2yrs) demeaned panel set	3.59***
• 2003-2008 (>2 yrs) panel set	2.80***
• 2003-2008 (>2 yrs) demeaned panel set	3.06***
Consumer credit spreads	
• 1995-2002 panel set	-2.50**
• 1995-2002 demeaned panel set	-1.20
• 2003-2008 (1yr) panel set	2.42**
• 2003-2008 (1yr) demeaned panel set	4.29***
• 2003-2008 (1-5yrs) panel set	0.64
• 2003-2008 (1-5yrs) demeaned panel set	1.29
Mortgage spreads	
• 1995-2002 (2-5yrs) panel set	9.79***
• 1995-2002 (2-5yrs) demeaned panel set	2.12**
• 2003-2008 (1-5yrs) panel set	0.61
• 2003-2008 (1-5yrs) demeaned panel set	-0.62
• 2003-2008 (5-10yrs) panel set	1.28
• 2003-2008 (5-10yrs) demeaned panel set	1.19
• 2003-2008 (>10yrs) panel set	-2.33**
• 2003-2008 (>10yrs) demeaned panel set	-0.93

Note:

1. The critical values for the CD tests [standard two-tailed normal distribution] for 10%, 5% and 1% significance levels are ±1.645, ±1.96 and ±2.575 respectively
2. The CD test statistics were run for each lag order (p) ranging from 1 to 12 and given similar results, the CD statistics reported in the table corresponds to p=6
3. The CD statistics were computed in OxEdit using the GAUSS code provided by Yamagata (2006)

   *** indicates significance at the 1% level, ** significant at 5%, * significant at 10%.

Table 5G.2: Pesaran (2007) panel unit root test (CIPS) on spreads

Panel data	CIPS panel unit root tests
Deposit spreads	
• 1991-2002 panel set	-1.916 (p=6)
• 1991-2002 demeaned panel set	-3.513***(p=7)
• 2003-2008 (1yr)panel set	-0.406 (p=7)
• 2003-2008 (1yr) demeaned panel set	-2.212* (p=7)
• 2003-2008 (1-2yrs)panel set	-1.822 (p =6)
• 2003-2008 (1-2yrs) demeaned panel set	-3.457 ***(p=7)
• 2003-2008 (>2 yrs) panel set	-2.431*** (p=5)
• 2003-2008 (>2 yrs) demeaned panel set	-3.418***(p=4)
Consumer credit spreads	
• 1995-2002 panel set	-2.091 (p=6)
• 1995-2002 demeaned panel set	-3.131*** (p=8)
• 2003-2008 (1yr) panel set	-1.246 (p=5)
• 2003-2008 (1yr) demeaned panel set	-2.849***(p=7)
• 2003-2008 (1-5yrs) panel set	-1.585 (p =7)
• 2003-2008 (1-5yrs) demeaned panel set	-2.935***(p=6)
Mortgage spreads	
• 1995-2002 (2-5yrs) panel set	-1.749 (p=6)
• 1995-2002 (2-5yrs) demeaned panel set	-4.055***(p=6)
• 2003-2008 (1-5yrs) panel set	-0.981 (p=7)
• 2003-2008 (1-5yrs) demeaned panel set	-2.798***(p=4)
• 2003-2008 (5-10yrs) panel set	-1.244 (p=5)
• 2003-2008 (5-10yrs) demeaned panel set	-2.911***(p=3)
• 2003-2008 (>10yrs) panel set	-1.540 (p=4)
• 2003-2008 (>10yrs) demeaned panel set	-3.023 ***(p=6)

Notes:

1. The CIPS critical values are listed in table 3b in Pesaran (2007).
   For N=9 and T=93, the critical values for 1%, 5% and 10% significance levels are around -2.53, -2.32 and –2.21 for case II [with intercept only]; For N=13 and T=93, the critical values for 1%, 5% and 10% significance levels are around -2.42, -2.25 and –2.15 for case II [with intercept only]; For N=15 and T=72, the critical values for 1%, 5% and 10% significance levels are approximately –2.43, -2.25 and –2.15 for case II [with intercept only]; For N=14 and T=144, the critical values for 1%, 55 and 10% significance levels are around -2.42, -2.25, and -2.15 for case II [with intercept only].
   *** denotes significance at 1%, ** at 5%, * at 10%.
2. The lag order selected for each panel data set is indicated within brackets and the model used includes an intercept.
3. The CIPS statistics were computed in OxEdit using the Gauss code written by Yamagata (2006).

Appendix 5H

Table 5H.1: Phillips and Sul (2007) Log *t* test

$$Log\left(\frac{H_1}{H_t}\right) - 2\log L(t) = \hat{a} + \hat{b}\log t + \hat{u}_t$$

Data series	$\hat{b}$	*t*-statistics
Deposit rates		
• 1991-2002 panel set	0.785	24.108
• 2003-2008 (1yr)panel set	1.607	9.200
• 2003-2008 (1-2yrs)panel set	1.027	10.706
• 2003-2008 (>2 yrs) panel set	0.102	10.154
Consumer credit rates		
• 1995-2002 panel set	-0.077	-3.824*
• 2003-2008 (1yr) panel set	-0.050	-5.967*
• 2003-2008 (1-5yrs) panel set	-0.215	-20.425*
Mortgage rates		
• 1995-2002 (2-5yrs) panel set	0.587	7.100
• 2003-2008 (1-5yrs) panel set	0.521	17.424
• 2003-2008 (5-10yrs) panel set	0.389	14.866
• 2003-2008 (>10yrs) panel set	-0.099	-1.692*

Note
-The Phillips and Sul (2007) log t-test were run in OxEdit using the Gauss code programmed by Sul (2007)
* Indicates rejection of the null hypothesis of convergence at the 5% significance level.

Appendix 5H

Table:.5H.2. Phillips and Sul (2007) Club Convergence Test

$$Log\left(\frac{H_1}{H_t}\right) - 2\log L(t) = \hat{a} + \hat{b}\log t + \hat{u}_t$$

Data series	$\hat{b}$	*t*-statistics
1991-2002 short-term deposit panel data set		
Club 1: Austria, Belgium, Germany, Denmark, Portugal, Spain, France, Finland, Sweden, Greece, Netherlands, UK	1.509	16.152
Club 2: Ireland, Italy	-0.017	-0.647
2003-2008 (1yr mat.) deposit panel data set		
Club 1: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, UK	1.523	11.341
2003-2008 (1-2yrs)deposit panel data set		
Club 1: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, UK	0.881	16.067
2003-2008 (>2 yrs) deposit panel data set		
Club 1: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, UK	0.198	16.454
Divergent country: Ireland		
1995-2002 consumer credit panel data set		
Club 1: Belgium, Germany, France, Portugal, UK	0.220	5.331
Club 2: Austria, Spain	0.279	7.527
Club 3: Finland, Sweden	1.068	3.345
2003-2008 (1yr) consumer credit panel data set		
Club 1: Austria, Denmark, Spain, Finland, France, Ireland, Italy, Netherlands, Portugal, Sweden	0.002	0.065
Club 2: Belgium, Germany, Greece, UK, Luxembourg	0.348	10.843

Table:.5H.2 Cont'd		
Data series	$\hat{b}$	*t*-statistics
2003-2008 (1-5yrs) consumer credit panel data set		
Club 1: Austria, Portugal, UK	0.277	12.013
Club 2: Belgium, Germany, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Luxembourg, Netherlands, Sweden	0.187	5.684
1995-2002 (2-5yrs) mortgage panel data set		
Club 1: Austria, Belgium, Germany, Spain, France, Italy, Netherlands, Portugal, Sweden, UK	0.333	4.156
Club 2: Finland, Ireland, Luxembourg	4.893	22.906
2003-2008 (1-5yrs) mortgage panel data set		
Club 1: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, UK	0.221	5.916
2003-2008 (5-10yrs) mortgage panel data set		
Club 1: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, UK	0.281	8.653
2003-2008 (>10yrs) mortgage panel data set		
Club 1: Austria, Belgium, Germany, Denmark, Spain, Finland, France, Greece, Italy, Netherlands, UK	-0.363	-12.394*

Note:
-The Phillips and Sul (2007) club clustering log t-test were run in OxEdit using the Gauss code programmed by Sul (2007)
* Indicates rejection of the null hypothesis of convergence at the 5% significance level.

Chapter 6

Convergence of deposit and lending rates to non-financial corporations

6.1 Introduction

The empirical analysis of the degree of integration process within the European Union 15[1] group of countries' retail banking sector is carried out by investigating a range of deposit and lending rates to non-financial corporations and to the household sector; the two sectors that make up retail banking business. The previous chapter set out a detailed analysis of deposit and credit rates to the household sector. This chapter focuses on the analysis of deposit and lending rates to the non-financial corporations for the 15 EU countries. The main contributions of this chapter are as follows. Firstly, a detailed investigation is carried out on the deposit and lending instruments for the non financial corporations covering the periods 1991-2002 and 2003-2008, hence providing a comparison between the 1990s and the more recent period. These interest rates have been grouped into different data sets based on maturity duration so as to ensure consistency and comparability throughout the analysis.

Secondly, this research is the first one to take into consideration the impact of structural breaks on the interest rate spread data by applying a popular and powerful multiple stochastic break model to each individual deposit and lending spread series. This process also enables an analysis of the timing and pattern of the break dates to ascertain whether any clustering of common shocks can be detected. Thirdly, the effects of these breaks are removed by demeaning each individual spread data series before applying

[1] Austria (AT), Belgium (BE), Denmark (DK), Germany (DE), Finland (FI), France (FR), Greece (GR), Ireland (IE), Italy (IT), Luxembourg (LUX), Netherlands (NL),Portugal (PT), Sweden (SE), Spain (ES), United Kingdom (UK).

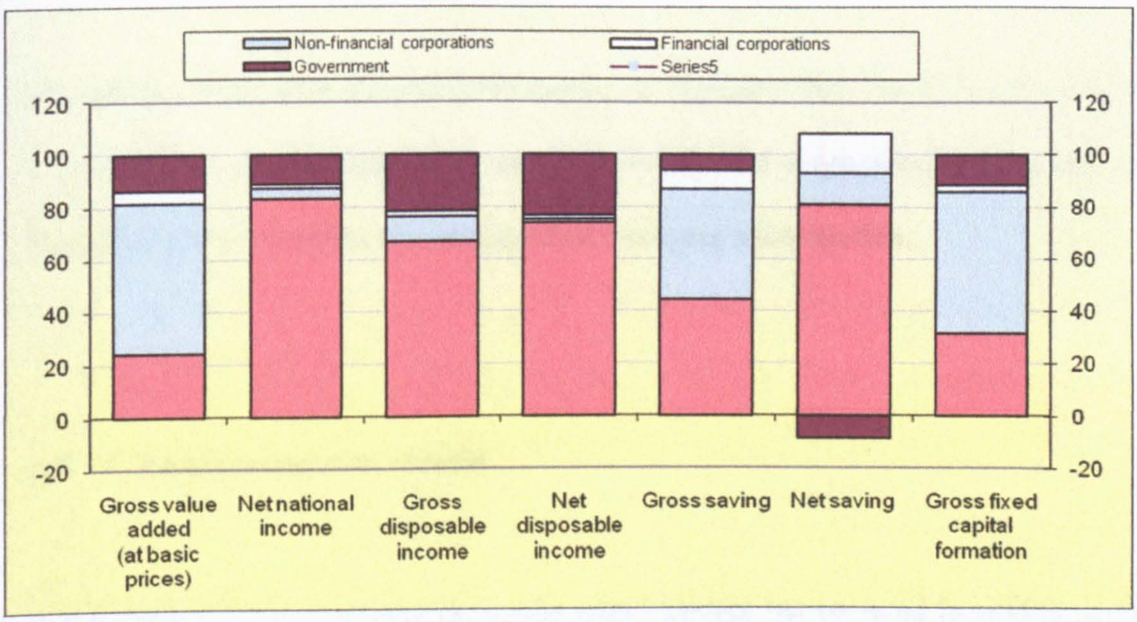
panel unit root tests. The other econometric convergence tests applied are bivariate cointegration tests; and a recently developed powerful and flexible panel convergence test. The latter methodology has not been hitherto employed in this area and is ideally suited for this research as it not only provides information on the degree of convergence for the retail rates but also maps out the individual convergence path and indicates whether any sub-group of countries are converging or diverging.

This chapter is structured as follows: section 6.2 gives a brief overview of the non-financial services sector while sections 6.3 up to 6.9 discuss the empirical results obtained under the Augmented Dickey-Fuller unit root tests, the Johansen cointegration tests, the Bai and Perron structural break tests, the Im, Pesaran and Shin and the Pesaran panel unit root tests, and the Phillips and Sul log-*t* and club clustering tests. Section 6.10 concludes.

6.2 Non-financial corporations sector

The European Union's non-financial services sector generates substantial turnover and value added within the economy for every member country. In fact, as illustrated in Figure 6.1 below, within the euro-area, the biggest share of GDP (around 60%) originates from non-financial corporations while the share of gross savings from this sector accounts for around 42%. The share of gross fixed capital formation for the non-financial corporations takes the lead at around 54% (Eurostat, 2009). The same trends are observable for the whole European Union group of member states and amongst, based on 2006 value added figures; the United Kingdom has the largest non-financial services sector followed by Germany, France and Italy (Stawinska, 2009).

Figure 6.1: Shares of sectors in key aggregates for the euro area, 1999 - 2008 average



Source: Eurostat (2009)

Hence, given the substantial share of the EU's non-financial services sector's saving and borrowing activities, the retail banking rates to this sector serve as an ideal platform to analyse the integration process. The methodologies discussed in Chapter 4 are applied to the following 8 data sets which have been compiled for all 15 EU countries:

- Short-term lending rates (1991-2002)
- Bank overdrafts (2003-2008)
- Lending rates with up to 1 year; 1-5 years; and over 5 years maturities, respectively (2003-2008)
- Deposit rates with up to 1 year; 1-2 years; and over 2 years maturities, respectively, (2003-2008)

Additional information on each data set is provided in appendix 6A.

6.3 Augmented Dickey-Fuller Unit root tests

The tables for the ADF statistics are reported in Appendix 6B. The ADF tests show that all the deposit and lending rates series to non-financial corporations have a unit root. Therefore, these variables can be entered in a cointegration relation.

6.4. Cointegration test results

The Johansen VAR cointegration model with intercept but no trend is used to perform the cointegration analysis. The lag order for each VAR model, which includes each country's deposit/lending rate and the corresponding European deposit/lending rate, is selected according to the Akaike Criterion. The bivariate cointegration analysis has been performed on each deposit/lending rate series and the corresponding European weighted average. The trace and maximum eigenvalue test statistics are obtained at the 1% and 5% significance level and are reported in Appendix 6C.

6.4.1 Cointegration results for the deposit rates to non-financial corporations

The Johansen cointegration tests provide some insightful information regarding the integration process in the European retail banking sphere. The level deposit rates with 1 year maturity for the period 2003-2008 show the presence of cointegration for 11 out of the 15 EU countries. No cointegration is detected for Belgium, Denmark, Ireland and

Portugal. The level deposit rates with 1-2 years maturity for the same period show the presence of cointegration for 9[2] countries while no cointegration is detected for the remaining 6 countries. A fairly similar picture emerges when the deposit rates with over 2 years maturity for the period 2003-2008 are tested where cointegration is observed for 7[3] out of the 13 countries.

Some countries such as Belgium, Ireland, Netherlands, Portugal and UK show predominantly the absence of cointegration when the deposit rates with 1year, 1-2 years and over 2 years maturities are tested for the period 2003-2008. Looking into the retail banking business for these countries, there seems to be evidence to explain the lack of integration for the deposit rates. For instance, in Belgium, the main factor that seems likely to contribute to a lack of integration is the fact that in this Member State, interest paid on savings accounts by domestic banks is tax-exempted while interest paid by foreign banks is not[4] (Europa, 2010). These tax incentives are very likely to bias non-financial corporations towards local banks as opposed to foreign ones. Netherlands, Portugal, Ireland and the UK also offer some kind of tax incentives, but to a lesser extent (European Commission, 2006d). Another striking fact with regards to the banking retail market in these countries, (especially in Belgium, Netherlands and UK) is the high level of market concentration. Indeed, in the UK and the Netherlands, the banking sector is dominated by large oligopolistic national players while Belgium is one of the most concentrated markets among the EU (European Commission, 2007b). It can be argued that higher concentration ratios typically signal lower levels of competition and thus integration. The lack of cointegration for the deposit rates for Ireland can also be attributed to a lack of competition such as little price competition paid on current

[2] AT, DE, DK, ES, FI, FR, GR, IE, PT

[3] AT, BE, DE, DK, FI, IT, ES

[4] In May 2010, the European Commission has decided to refer Belgium to the European Court of Justice in order for these tax provisions to be amended.

accounts, high switching costs and unclear procedures with regards to admitting new members to the payment clearing system. In addition, customers in Ireland have reported that proximity to their retail banks as well as family history with a specific provider are important determinants in choosing their retail bank (European Commission, 2006).

Interestingly, based on the findings of the Johansen cointegration tests, it can also be observed that deposits rates with the shorter maturity period show much stronger convergence between the individual deposit rates series and the weighted European average than the deposit rates with the longer maturities. Drawing parallels between the cointegration results for these deposit rates and those for the household sector, it can be observed that there are overwhelmingly weaker levels of integration for all deposit rates for the household sector, irrespective of maturity duration. These findings are in line with those of the report by European Commission (2006) which finds that there are higher variations for household rates compared to non-financial corporation rates. Furthermore, the report also indicates that higher dispersion rates are evident for longer-term deposit rates to non-financial corporations as compared to short term ones.

The disparity in findings for the household and non-financial corporations sectors could be mirroring the disparity in the price elasticity of demand for deposit rates for households and small enterprises. As widely argued (see European Commission, 2006), the savings market for the household sector is typically characterised by a low price elasticity of demand due to customer inertia. However, with regards to enterprises, the higher degree of integration for the short-term deposit rates could signify a more elastic demand for such instruments as these are widely used by them given the relatively quick access to their savings and the fact that generally, the bulk of the payments they make and receive are conducted on such accounts. On the other hand, with regards to the savings market for deposit rates with longer maturities for non-financial corporations, there is likely to be less demand and therefore competition in the market for such instruments. As discussed in Chapter 5 in Section 5.10.2.4, studies by Sorensen and Werner (2006) and Gropp et al (2007) report sluggishness in interest-rate pass through for deposit rates with longer maturities and also find a strong link between the speed of interest-rate adjustments and competition.

6.4.2 Cointegration results for the lending rates to non-financial corporations

Akin to the findings obtained for the deposit rates, the cointegration results for the lending rates to non-financial corporations also allow for some very meaningful deductions to be formulated[5]. The level short-term lending rates for the period 1991 to 2002 show the presence of one cointegration equation for the rates of only four countries, namely, Austria, Spain, Greece and Portugal while the remaining 10 countries show no evidence of cointegration, suggesting that the short-term lending rates for the earlier period were not integrated on a European level. This is in line with the findings in the earlier literature in this area.

A very similar observation can be made on the behaviour of the short-term lending rates for the more recent period of 2003-2008. The level data series for this period show the absence of cointegration for all the 15 countries in the data set. The same pattern can also be observed for the overdraft rates for the period 2003-2008. The level data series show the presence of cointegration for only 3 countries, namely France, Italy and Spain

[5] Note: the trace and maximum eigen statistics are reported in Table 6C2, Appendix 6C.

while the remaining 11 countries show no convergence towards the European weighted rates. Similarly, with the level data series for the lending rates with 1-5 years maturity for the period 2003-2008, the majority (11 countries) of the data series showing no cointegration. The presence of convergence is observed only for four countries, namely, Austria, France, Greece and Ireland.

As for the lending data series with over 5 years' maturity and for the same period, the results drawn show an analogous behaviour to the previous data set. The level data set reveal the presence of cointegration for just 4 of the 15 countries, namely, Austria, Finland, Italy, and the UK.

Overall, the analysis of the cointegration results for the lending rates indicates limited convergence in the lending market to non-financial corporations for the period 1991-2008. This is in contrast to the deposit retail market to these institutions whereby stronger signs of convergence are detected. Furthermore, the results for the lending rates to non-financial corporations are comparable to those obtained for the consumer credit rates.

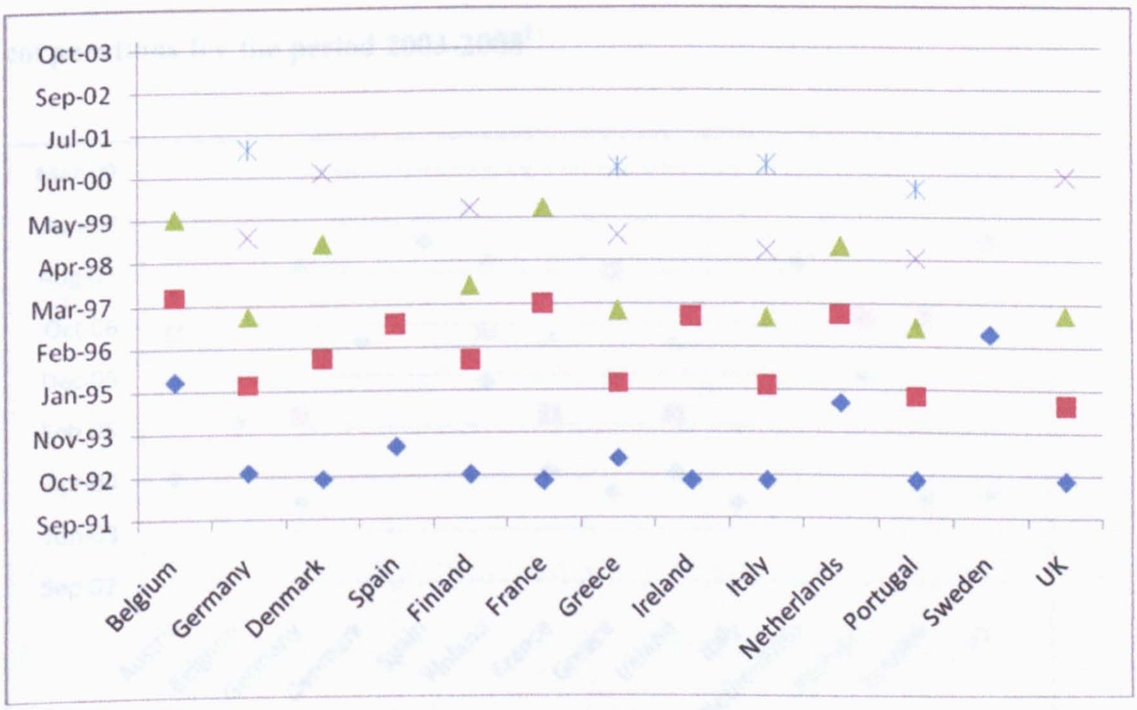
6.5 Structural breaks tests results for the deposit and lending spreads to non-financial corporations

The Bai and Perron (1998) structural break tests have been conducted using the Pierre Perron's[6] GAUSS program and have been conducted in OxEdit[7]. The Bai and Perron (1998) *UD*max and *WD*max and the $SupF_T(m+1|m)$ statistics are reported in Tables

[6] The GAUSS program is available from Pierre Perron's home page at http://econ.bu.edu/perron/.
[7] The results are generated using Ox version 4.00 (see Doornik, 2005)

6D.1 to 6D.8 of appendix 6D. For all the deposit and lending spread series for the periods 1991-2008, the *UD*max and *WD*max indicate the presence of mean breaks. The $SupF_T(m+1|m)$ statistics suggest a selection of to 3-5 breaks for the deposit and lending rates for the period 1991-2002 and the selection of predominantly 2 breaks for the period 2003-2008. The specific break dates for each spread data series are listed in Appendix 6E. The break-dates for the EU countries for the first data series are charted below.

Figure 6.2 Structural break dates for the short-term lending spreads to non-financial corporations for the period 1991-2002[8]



As illustrated above in Figure 6.2, most of the countries in the sample exhibit between 3 to 5 breaks while very few countries have only 1 or 2 breaks. A clear pattern in the timing of the first break is observable for this data series, with eight[9] countries showing

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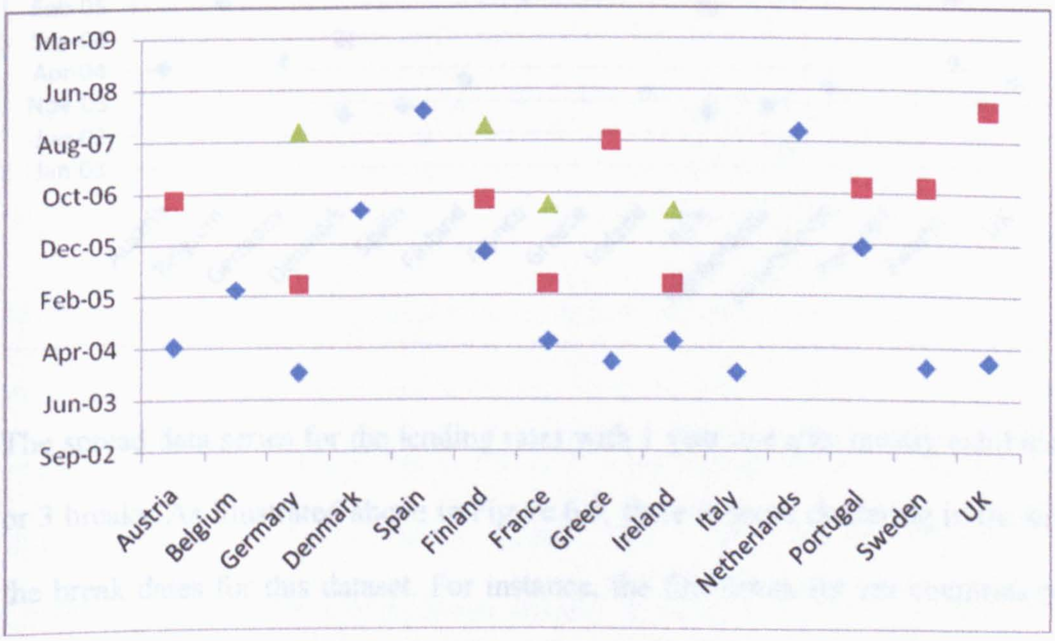
[8] ◆ Denotes the first break; ■ denotes the second break; ▲ denotes the third break, and × denotes the fourth break. ✳ denotes the fifth break.

[9] DE, DK, FI, FR, IE, IT, PT,UK

a break between September to December 1992 while another 2 countries (Greece and Spain) have a break in April/August 1993. The next break for most of the spread series is between August to November 1994 for Netherlands, Portugal and UK while for another five[10] countries it occurs in February/March or October/November 1995. Another common break for seven countries, namely Germany, Spain, Ireland, Italy, Portugal, Sweden and UK takes place between June to December 1996. In 1998, six of the countries have a break between May to December, but predominantly in December. Subsequently, Denmark, Greece, Italy, Portugal and UK have a break between February to September 2000 while Germany has a final break in March 2001.

Figure 6.3 Structural break dates for the overdraft spreads to non-financial corporations for the period 2003-2008[11]



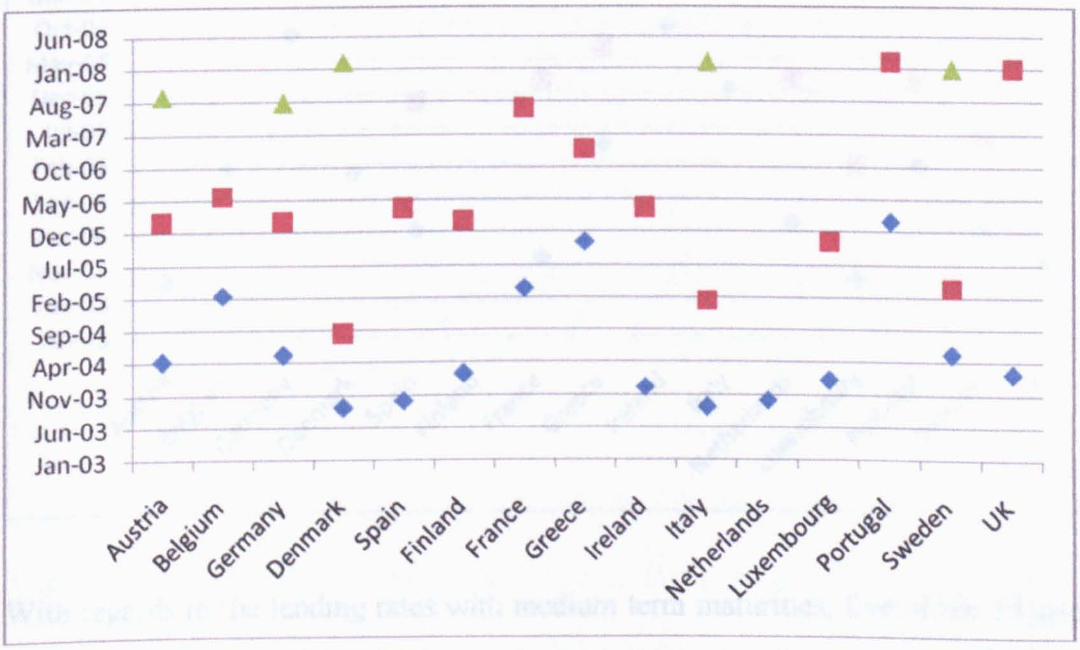
With regards to the overdraft spread series for the 2003-2008 period, 10 out of the 14 countries have either one or two breaks while the remaining four have 3 breaks. As illustrated above in Figure 6.3, some evidence of clustering of the break dates is visible

[10] DE, DK, FI, GR, IT

[11] ◆ Denotes the first break; ■ denotes the second break; and ▲ denotes the third break.

for this data set. For instance, eight countries have a break either in December 2003 or between January to June 2004. The next clustering of breaks is between July to November 2006 and involves six[12] countries. Subsequently, Germany, Finland, Greece, and Netherlands have a break between August to November 2007 while Spain and UK have a break in February 2008.

Figure 6.4 Structural break dates for the 1-year lending spreads to non-financial corporations for the period 2003-2008[13]



The spread data series for the lending rates with 1 year maturity mostly exhibit either 2 or 3 breaks. As illustrated above in Figure 6.4, there is some clustering in the timing of the break dates for this dataset. For instance, the first break for ten countries occur in October/November 2003 or between January to June 2004. Belgium, France and Greece, on the other hand, have their first break in March/April/November 2005 respectively. The next common break involving seven[14] countries occurs between February to June

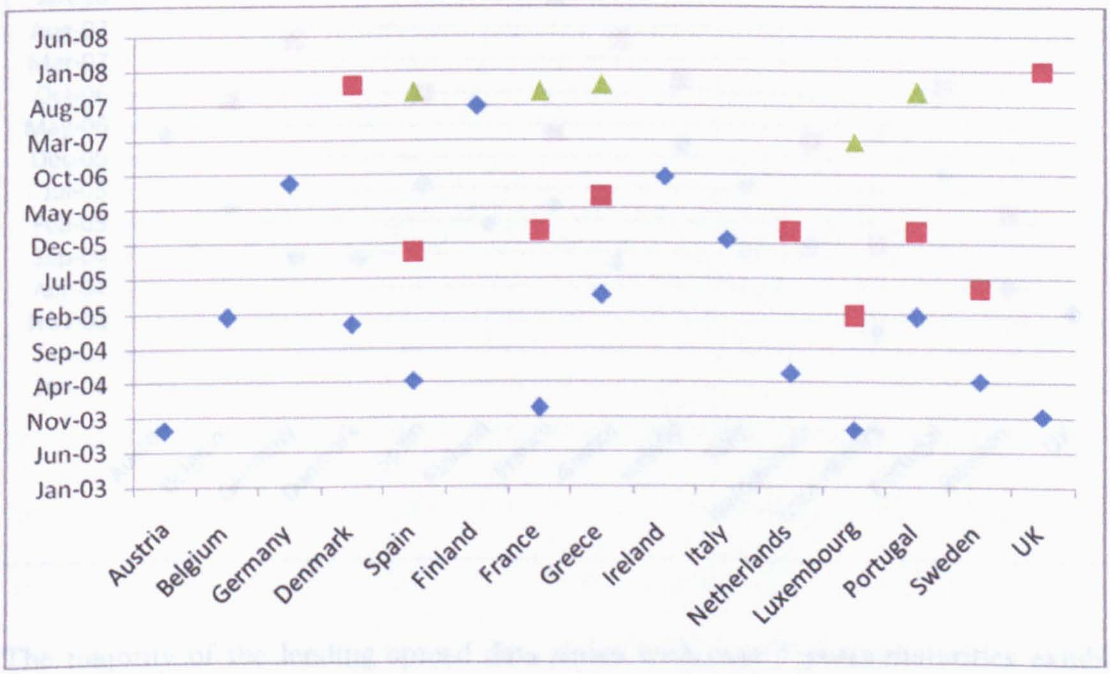
[12] AT, DK, FI, FR, IE, PT,

[13] ◆ Denotes the first break; ■ denotes the second break; and ▲ denotes the third break.

[14] AT, BE, DE, ES, FI, IE,PT

2006 but predominantly in February. Subsequently, Austria, Germany, France and Greece have a break January to September 2007 while Denmark, Italy, Portugal and UK have their break in January/February 2008.

Figure 6.5 Structural break dates for the 1-5years lending spreads to non-financial corporations for the period 2003-2008[15]

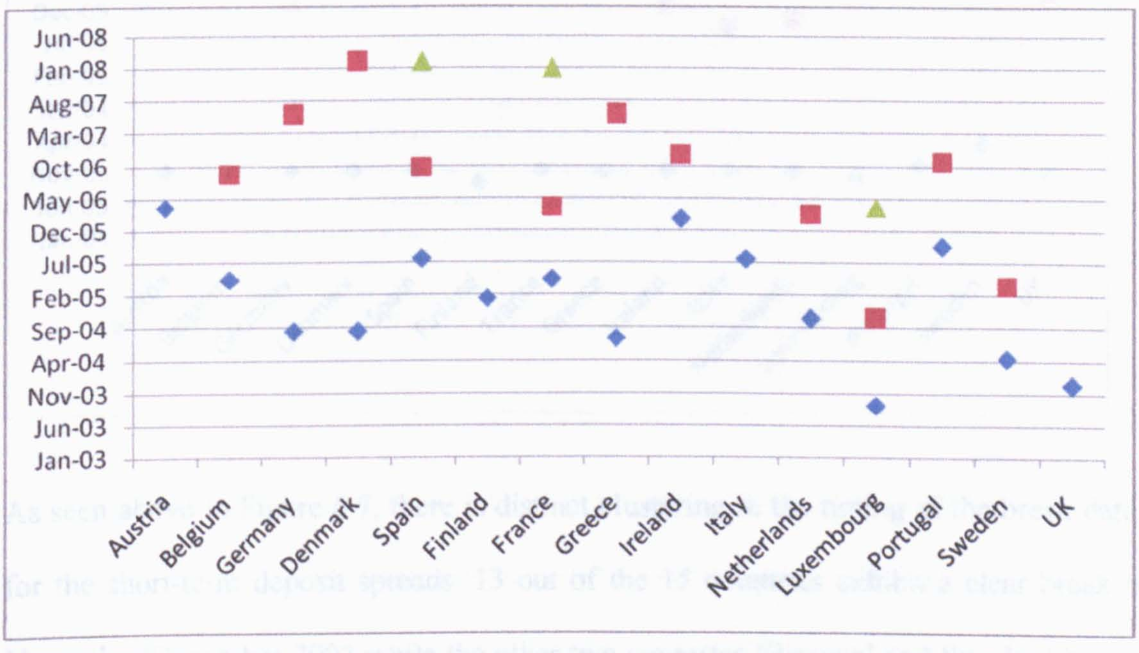


With regards to the lending rates with medium term maturities, five of the 15 countries experience 3 breaks while four countries have 2 breaks and six countries show one break only. As illustrated above in Figure 6.5, the timings of the breaks closely mirror those of the short-term lending spreads. Six [16] countries have break either in October/December 2003 or between January to June 2004. Two of these countries, namely Luxembourg and Sweden plus Belgium, Denmark, Greece, and Portugal also have a break between January to June 2005. The next common break exhibited by

[15] ◆ Denotes the first break; ■ denotes the second break; and ▲ denotes the third break.
[16] AT, ES, FR, NL, LUX, SE, UK

seven[17] countries occur between February to September 2006 (mostly in February) while between March to November 2007, again seven[18] countries have a break.

Figure 6.6 Structural break dates for the over 5-years lending spreads to non-financial corporations for the period 2003-2008[19]



The majority of the lending spread data series with over 5 years maturities exhibit 2 breaks while the rest have either 1 or 3 breaks. The pattern in the break dates is again fairly similar to the other lending spread data sets for the period 2003-2008. A break for Germany, Denmark, Greece, Luxembourg, Netherlands, Sweden and UK occurs between January to November 2004 while Belgium, Spain, Finland, France, Italy, Portugal have a break between February to October 2005. Six[20] of these countries as well as Austria have a break between April to December 2006. So overall, it can be observed that most of the breaks tend to occur between the years 2004 to 2006.

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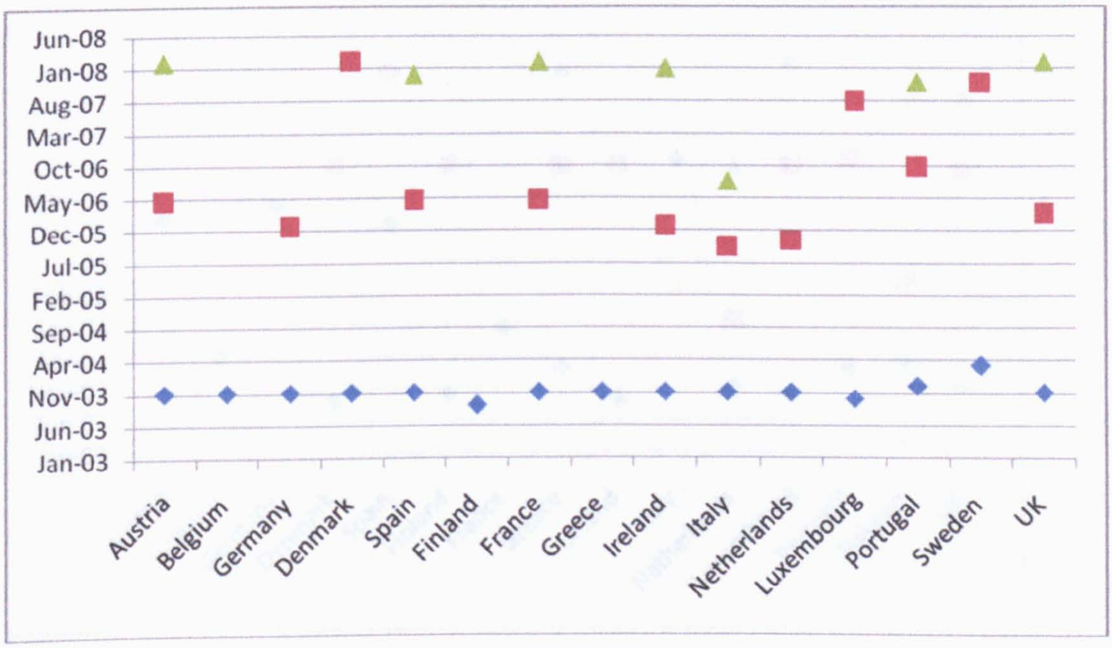
[17] DE, FR, GR, IE, IT, NL, PT

[18] DK, ES, FI, FR, GR,LUX, PT

[19] ◆ Denotes the first break; ■ denotes the second break; and ▲ denotes the third break.

[20] BE, ES, FR, IE, NL,PT

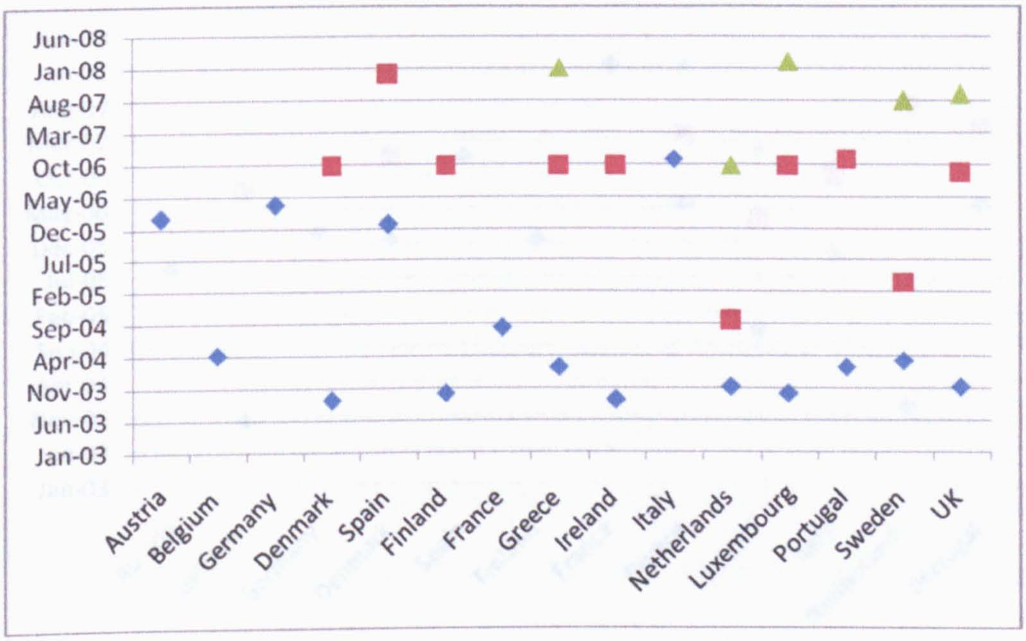
Figure 6.7 Structural break dates for the 1-year deposit spreads to non-financial corporations for the period 2003-2008[21]



As seen above in Figure 6.7, there is distinct clustering in the timing of the break dates for the short-term deposit spreads. 13 out of the 15 countries exhibit a clear break in November/December 2003 while the other two countries (Portugal and Sweden) have a break in January/April 2004. The second evident break for eight[22] of the countries occurs January to October 2006 but predominantly in the first half of the year. Spain, Luxembourg and Sweden have break in the later half of 2007 while Austria, Denmark, France and Greece have a break in January/February 2008.

[21] ◆ Denotes the first break; ■ denotes the second break; and ▲ denotes the third break.
[22] AT, DE, ES, FR, IE, IT, PT, UK

Figure 6.8 Structural break dates for the 1-2 years deposit spreads to non-financial corporations for the period 2003-2008[23]



With regards to the individual deposit spread series with medium-term maturities, six countries have three breaks while the remaining countries have either one or two breaks (see Figure 6.8 above). The pattern in the break dates is consistent with the observations noted earlier for the short-term deposit spreads whereby most of the breaks happen in late 2003/early 2004 and in 2006. Once more, most[24] of the countries have a break either between October to December 2003 or between March and May 2004. Twelve[25] of the countries also have a break between January to November 2006.

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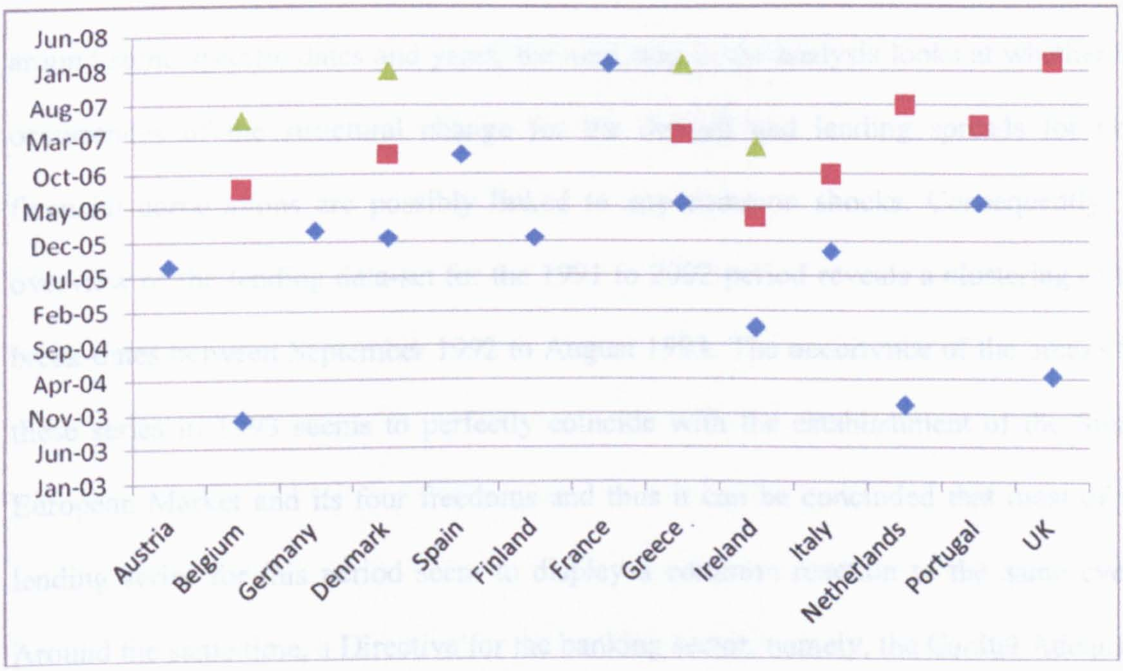
[23] Denotes the first break; denotes the second break; and denotes the third break.

[24] BE, DK, FI, FR, GR, IE, NL, LUX, PT, SE, UK

[25] AT, DE, DK, ES, FI, GR, IE, IT, NL, LUX, PT, UK

Figure 6.9 Structural break dates for the over-2years' deposit spreads to non-financial corporations for the period 2003-2008[26]



With regards to the deposit spreads with over 2 years' maturity, five of the countries have one break while the remaining countries have either two or three breaks (see Figure 6.9 above). Interestingly, for this data set, the timing of the breaks do not follow the same pattern observed for the pervious two deposit spreads datasets. In this case, the most obvious common break occur between February to October 2006 and involve eight[27] countries. The next noticeable break affecting seven[28] countries take place between January to August 2007. Denmark, France, Greece and the UK, on the other hand, have their final break later in January/February 2007.

[26] ◆ Denotes the first break; ■ denotes the second break; and ▲ denotes the third break.
[27] BE, DE, DK, FI, GR, IE, IT, PT
[28] BE, DK, ES, GR, IE, NL, PT

6.5.1 Analysis of the pattern in the break dates for the spread data

Given that the timing of the break-dates for all the 8 datasets above are clearly clustered around some specific dates and years, the next step in the analysis looks at whether the occurrences of the structural change for the deposit and lending spreads for non-financial corporations are possibly linked to any common shocks. Consequently, an overview of the lending data-set for the 1991 to 2002 period reveals a clustering of the break-dates between September 1992 to August 1993. The occurrence of the breaks for these series in 1993 seems to perfectly coincide with the establishment of the Single European Market and its four freedoms and thus it can be concluded that most of the lending series for this period seem to display a common reaction to the same event. Around the same time, a Directive for the banking sector, namely, the Capital Adequacy Directive of 1993 was formally adopted. The Capital Adequacy Directive aims at establishing uniform capital requirements for banks and other investment and credit institutions by specifying the capital adequacy requirements, their calculation and the rules for their prudential supervision. The main objective of this Directive is to enhance financial stability and integrity (see Chapter 3 for further details).

Furthermore, in the remaining seven lending and deposit spread series for the period 2003 to 2008, it can be observed that the majority of the individual series exhibit a break in late 2003 and/or in 2004. The timing of these breaks match the following events. Firstly, in November 2003, the European Commission decided to set up the European banking Committee with the remit of overseeing the application of community legislation and ensuring convergence in supervisory practices. This significant development is likely to have triggered a shock in the interest rate spread data. Secondly, in April 2004, the European Parliament adopted a Directive on markets in financial instruments with the aim of regulating the activities of individuals and businesses that provide a range of financial services to investors across the EU. A set of comprehensive measures on matters pertaining to investment activities; organisational requirements for investment firms; and transparency conditions for share transactions have been outlined in this directive.

The next popular timing for the occurrence of a break is in 2006. Again, the timing of the break date seems to coincide closely with some key events in the world of European banking. Firstly, in June 2006, an amended Capital Requirement Directive[29] for banks and investment firms was formally adopted by the European Council and Parliament. This Directive updates the supervisory framework in the EU and also reflects the Basel II rules on capital standards agreed upon at the G-10 level. Secondly, another event which may have had a role to play in the happening of the breaks is the adoption by the European Council and Parliament of the Services Directive, also known as the Bolkestein Directive. This directive is a major issue for the European Union as it seeks to eliminate the barriers in services across the EU and complete the single market. Thirdly, in the first half of 2006, substantial progress was also achieved with regards to the implementation of the Single Euro Payments Area (SEPA), with the deployment phase on direct debit instruments and cards framework well under-way. The SEPA initiative is highly significant for the European banking sector, as it would remove the existing legal and technical barriers for cross-border payment (see Chapter 3 for a detailed discussion).

The third most common break point for all the 2003-2008 data series happen predominantly in the second half of 2007. Again, the timing seems to match key events

[29] Refer to Chapter 3.

within the European banking sector in the form of the start of consultations in Mid-March 2007 by the Committee of European Banking Supervisors (CEBS) on the establishment of a mediation mechanism between banking supervisors. This culminated into the publication of a paper by the CEBS on the "Range of practices on supervisory colleges and home-host cooperation", as well as a template for a "Multilateral Cooperation and Coordination Agreement" which aim at enhancing the efficiency of the supervisory regime as stipulated by the Capital Requirements Directive. These developments have further prompted more deliberations within the banking sector which could explain the shocks experienced by the interest rate data series. For example, within the retail banking sector, the European Savings Banks Group which boasts a network of around one third of the European retail banking sector, adopted a resolution on the future of EU banking supervisory framework in November 2007, whereby one of the main conclusion was the importance of consolidating the convergence process in supervisory practices within the EU banking sector.

Another potential trigger for a common break for the lending and deposit rates for the non-financial corporation sector is the Green Paper on retail financial services in the single market which was presented by the European Commission in May 2007. This agreement seeks to further strengthen consumer protection and regulation of service providers. Consultations on this Green Paper took place later in September 2007 and the conclusions were later incorporated in the review of the single market, entitled "A single market for 21st century Europe"[30] in November 2007. Another key development in December 2007 is the adoption of the Payment Services Directive which seeks to harmonise the rules on payment services and provide a uniform platform for effective

[30] http://ec.europa.eu/internal_market/strategy/index_en.htm

and competitive cross-border payments to payment service providers via the use of SEPA.

Interestingly, it can be observed that the breaks for the deposit and lending spreads for both the household and non-financial corporations sectors coincide in some key months or years. For instance, the 1991-2002 series all show common breaks in 1993 while the 2003-2008 series have breaks predominantly in 2006 and 2007.

6.6 Panel unit root test: IPS (2003) test results

The Im, Pesaran and Shin (2003) panel unit root test results obtained for both the deposit and lending spreads and demeaned spreads are reported in Appendix 6F. The results for the level spread data differ completely from the results obtained for the demeaned spread data for all the panel sets tested. With regards to the deposit spread panel data sets which consist of the difference between each individual country rate and the European weighted average, the null hypothesis of a unit root cannot be rejected for all the 3 spread series. However, when the IPS is run on the demeaned panel spread data, the null hypothesis of a unit root is strongly rejected (even at the 1% significance level) for all the 3 types of deposit rates.

As for the lending data sets, the null of a unit root cannot be rejected when level spread data for short-term lending rates for the period 1991-2002 and 2003-2008 are tested In fact, similar results are obtained for all the remaining lending rates, i.e. overdraft rates (2003-2008), lending rates with 1-5 years maturity (2003-2008) and lending rates over 5 years maturity (2003-2008), when level spread data are tested. In sharp contrast, when the IPS test is run on the demeaned spreads, the null of a unit root is strongly rejected (even at the 1% significance level) for every lending rates panel data set.

The results obtained here emphasise two significant findings. Firstly, the presence of structural breaks can indeed distort or influence unit root test results as evidenced by the wide disparity in the unit root test results obtained for deposit/lending level spreads compared to demeaned spreads. Secondly, based on the more robust panel unit root tests while allowing for the presence of structural breaks, the presence of stationarity in every demeaned deposit and lending spread panel data set suggests convergence in the EU retail banking sector.

6.7 Pesaran's Cross Dependence test results

Before applying Pesaran's (2007) CIPS statistics, the deposit and lending spread panel data sets are tested for cross-section correlations by using the Pesaran (2004) diagnostic test. The results are tabulated in Appendix 6G, Table 6G.1. The CD test statistics show that there is indeed cross-dependence in all the level and demeaned deposit panel datasets, except for just one panel set; the 1-2 years demeaned spreads. As for the lending panel data sets, cross-dependence is also evident in all the level and demeaned sets except for two panel sets; the lending panel for both level and demeaned spreads with one year maturity. The overwhelming presence of cross-section correlation therefore clearly justifies the need to apply the CIPS panel unit root test.

6.8 Panel unit root test: Pesaran's (2007) CIPS test results

The results for the CIPS test for the panel of spreads (differences between each country deposit or lending rate and the corresponding European weighted average deposit/lending rate), both for the original and demeaned spreads, are shown in Appendix 6G, table 6G.2. The statistics are based on an autoregressive process including an intercept term only.

With regards to the deposit panel data sets with maturities ranging from 1 year to over 2 years for the period 2003-2008, the null hypothesis of a unit root cannot be rejected consistently throughout all 3 panel sets when level spread data is considered. However, the results change completely when the demeaned deposit spread panels are tested whereby the null of a unit root is rejected strongly, even at 1% significance level.

With regards to the short-term lending spreads for the period 1991-2002, the null of a unit root is strongly rejected for both level and demeaned spreads panel data sets, suggesting that the convergence in the lending sector was well underway in the 1990s. As for the lending rates for the period 2003-2008, the null of a unit root cannot be rejected for all the level spread data panel sets with maturities ranging from 1 year, 1-5 years and over 5 years. The same results are obtained for the level spread data panel overdraft rates for the same period. However, the null of a unit root is strongly rejected once the demeaned spread sets are tested for all the 3 categories of lending rates and for the overdraft rates.

Overall, it can be observed that the presence of stationarity in all the demeaned deposit and lending spread panels provide good reinforcement to the hypothesis of integration in the EU retail banking sector. Furthermore, the results obtained under the CIPS (2007) test strongly mirror those obtained under the IPS (2003) test statistics and again highlight the contrasting conclusions that can be drawn on the process of convergence depending on whether level spreads or demeaned spreads are tested.

6.9 Phillips and Sul (2007) panel convergence tests

6.9.1 Phillips and Sul (2007) log *t*-test

As per the recommendation of Phillips and Sul (2007), the convergence analysis is conducted on filtered data series whereby the cycle component of each series is removed using the Hodrick-Prescott (1997) filter. The t-statistics obtained for the convergence test for the 3 categories of deposit rates for the period 2003-2008 and for the five sets of lending rates ranging from the period 1995-2002 and 2003-2008 are tabulated in Table 6H.1, Appendix 6H.

The Phillips and Sul (2007) log *t*-test results provide strong support to the hypothesis of retail banking integration for the SME market in the EU as the null hypothesis of convergence cannot be rejected for all the deposit datasets and for 3 out of 5 of the lending panel data set tested. More specifically, it can be advocated that the deposit rates to non-financial corporations with 1 year, 1-2 years' and over 2 years' maturities respectively have all been converging over the period 2003-2008. Looking at the value of $\hat{b}$ for each of the panel data set also gives us an approximate of the pace of convergence, whereby a higher value of $\hat{b}$ indicates a faster rate of convergence. For the deposit rates with varying maturities, it can be observed that faster convergence can be detected for short-term deposit rates ($\hat{b}$ =2.271) and medium-term maturities

($\hat{b}$=3.090) than for long-term deposit rates ($\hat{b}$=0.480). These results are in line with the cointegration results discussed above in Section 6.4.1 whereby 11 out of the 15 countries in the sample for short-term deposit rates have a cointegrating relationship with the European average. The slower pace of group convergence detected here for the medium and especially for the longer term deposit rates also coincide with the mixed results obtained under the bivariate cointegration analysis.

As for the lending rates with short term maturities, convergence is detected in both periods tested; i.e. 1995-2002 and 2003-2008. However, the null of convergence is actually rejected for the overdraft rates and lending rates with 1-5 years' maturities for the period 2003-2008. On the other hand, for the lending rates with over 5 years' maturities for the period 2003-2008, the null of convergence cannot be rejected. Based on these log t-results, it can be seen that convergence is stronger and more consistent in the deposit market as opposed to the credit market. These results are similar to the findings from the cointegration analysis in Section 6.4

Furthermore, when the different panels where convergence is detected are compared, it can be seen that the fastest rate of convergence is detected for the short-term lending rates for the for the 1990s ($\hat{b}$=1.060), followed by the short term lending rates ($\hat{b}$=0.716) for the 2003-2008 period while a very slow rate of convergence is observed for the long-term lending rates ($\hat{b}$=0.051). These results match those of Bondt (2002) who indicate that lending rates to enterprises with short-term maturities for the period 1996 to 2001 have higher pass-through rates than longer-term lending rates. Similar results were obtained by Baele et al (2004) who find higher variability in the medium and long term loans to non-financial corporations for the period 2003 to 2004.

The disparity in the convergence processed based on maturity duration can be explained as follows. Firstly, the degree of competition is likely to be higher for short-term loans to enterprises due to the availability of other sources of short-term borrowing such as trade credit which would imply an elastic loan demand curve (Bondt, 2002). Secondly, the log *t*-test results for the lending rates can be explained through economic theories on term structure of interest rates, such as the expectations theory and the liquidity preference theory.

According to the expectations theory, long-term interest rates are determined by market expectations about the trajectory of future short-term interest rates. However, the study by Bondt et al (2005) question this rationale and using an error correction model on long term interest rates to enterprises (1994-2002), they find that European retail rates depend on long term interest rate, as evidenced by the sluggishness in their response to money market rates. If this is the case, then the interpretation from this analysis is that if the pricing of long term retail banking products depends on long term market rates which incorporate sovereign risk, then diversity among the lending rates of individual member states will exist. Also, banks are likely to price their long term retail products based on individual bank's perception and management of interest rate risk and therefore, the more diverse the pricing behaviour of banks, the less integrated the retail market is bound to be.

The second theoretical explanation for the limited convergence in medium-term and long-term lending rates is the liquidity preference theory whereby longer term interest rates not only reflect market expectations but also include a risk or liquidity premium to factor in the higher level of risk for the lender. A study by the ECB (2006) attempts to measure the impact of maturity fixation period on lending rates to non-financial corporations by working out the differences between these rates and the euro area yield curve. The findings show that the period of maturity does indeed have an impact on the lending rates with 1-5 years and over 5 years durations. Hence the underlying implication is that the duration of interest rate maturity may very well influence the lending rate by reflecting credit risk. This would, in turn, explain cross-country differentials and the weaker convergence rates for longer term instruments.

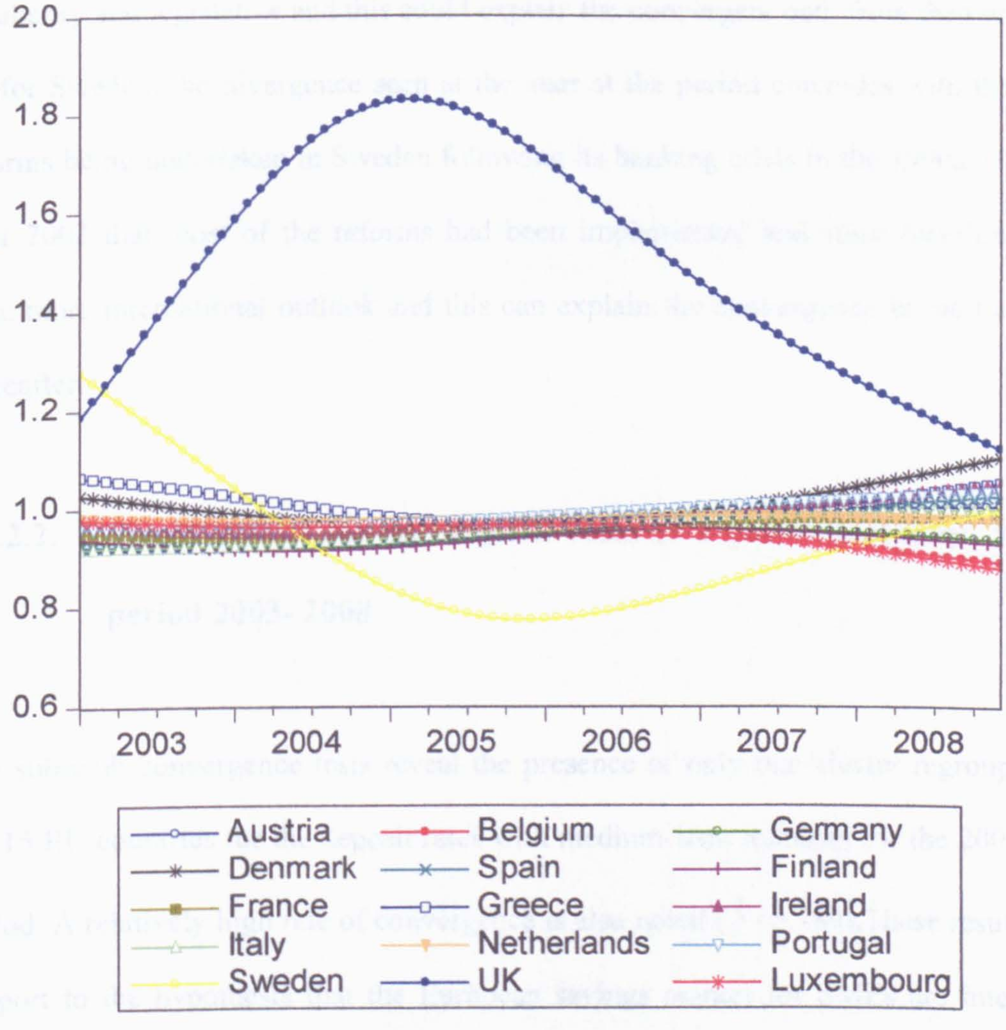
6.9.2 Phillips and Sul (2007) club clustering test and transition paths

Having established that convergence is present within all the 3 panels of deposit rates and in 3 out of 5 of the lending rates panels, the next step of the analysis is the application of the Phillips and Sul (2007) clustering algorithm which would indicate whether any sub-group convergence is taking place within the 15 group of EU countries. The test statistics are reported in appendix 6H, table 6H.2 and are discussed below. The third element of the convergence analysis is the calculation of each country's filtered relative transition coefficient $\hat{h}_{it}$ which summarises the country's behaviour vis-à-vis the panel average over time. Once completed, the transition curves for all countries within a panel are plotted together. This procedure is very insightful as it provides a visual illustration of the convergence process underway and also allows inferences to be drawn with regards to each individual country's transition path.

6.9.2.1 Panel results for the deposit rates (1 year maturity) for the period 2003-2008

With regards to the 2003-2008 deposit rates with 1 year maturity, only one cluster is identified regrouping all the 15 EU countries. A relatively high rate of convergence is also observed ($\hat{b}$=2.036). It is therefore obvious that with regards to the deposit rates with 1 year maturity, the majority of the 15 EU countries are closely converging. This fact is actually highlighted in the transition paths (see Figure 6.10).

Figure 6.10 Transition paths for each country's deposit rates (1 year maturity)

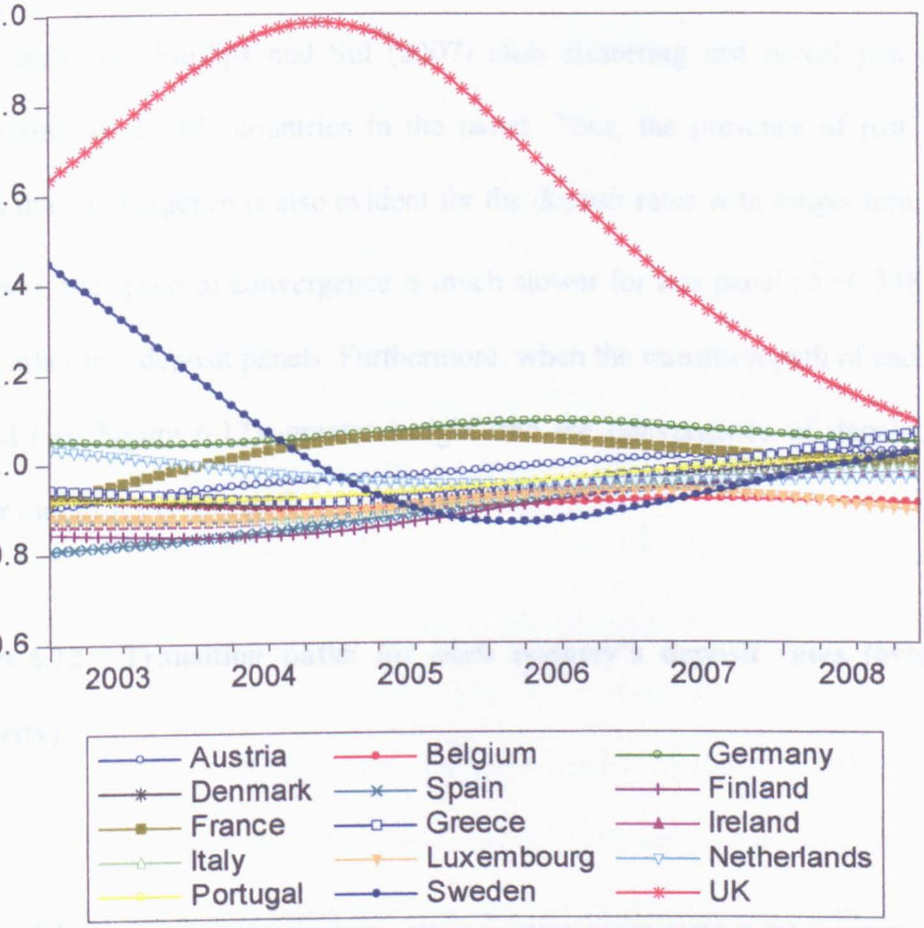


As depicted in Figure 6.10, all the countries in the panel, except for UK and Sweden are strongly convergent over the whole period, as their transition curves are moving asymptotically towards one. The UK's transition curve diverges away from one between the period 2003 to 2005 and then changes course and gradually moves in tandem with the other countries. The same can be observed for Sweden except that its transition curve has a negative slope until 2005 where after it converges towards one. Interestingly a similar observation is made for the short-term deposit rates to the household sector for these two countries. As discussed in the Chapter 5 in Section 5.10.2.2, the unique characteristics of the UK retail banking market and the fact that it is outside of the Euro-zone could well explain the divergent path observed at the start of the period. However, around the years 2004/5, the UK embraced several EU centred regulatory and legislative and this could explain the convergent path from then onwards. As for Sweden, the divergence seen at the start at the period coincides with the major reforms being undertaken in Sweden following its banking crisis in the 1990s. It is only after 2003 that most of the reforms had been implemented and since Swedish banks have more international outlook and this can explain the convergence in the time path thereafter.

6.9.2.2. Panel results for the deposit rates (1-2 years' maturity) for the period 2003- 2008

The sub-club convergence tests reveal the presence of only one cluster regrouping all the 15 EU countries for the deposit rates with medium-term maturity for the 2003-2008 period. A relatively high rate of convergence is also noted ($\hat{b}$=2.789).These results lend support to the hypothesis that the European savings market for SMEs are integrated. Furthermore, as illustrated by the individual countries' transition paths in Figure 6.11 below, the clustering of countries for the deposit rates with the 1-2 years maturities seem to be as pronounced as with the previous data set with 1 year maturity (see Figure 6.10).

Figure 6.11 Transition paths for each country's deposit rates (1-2 years' maturity)

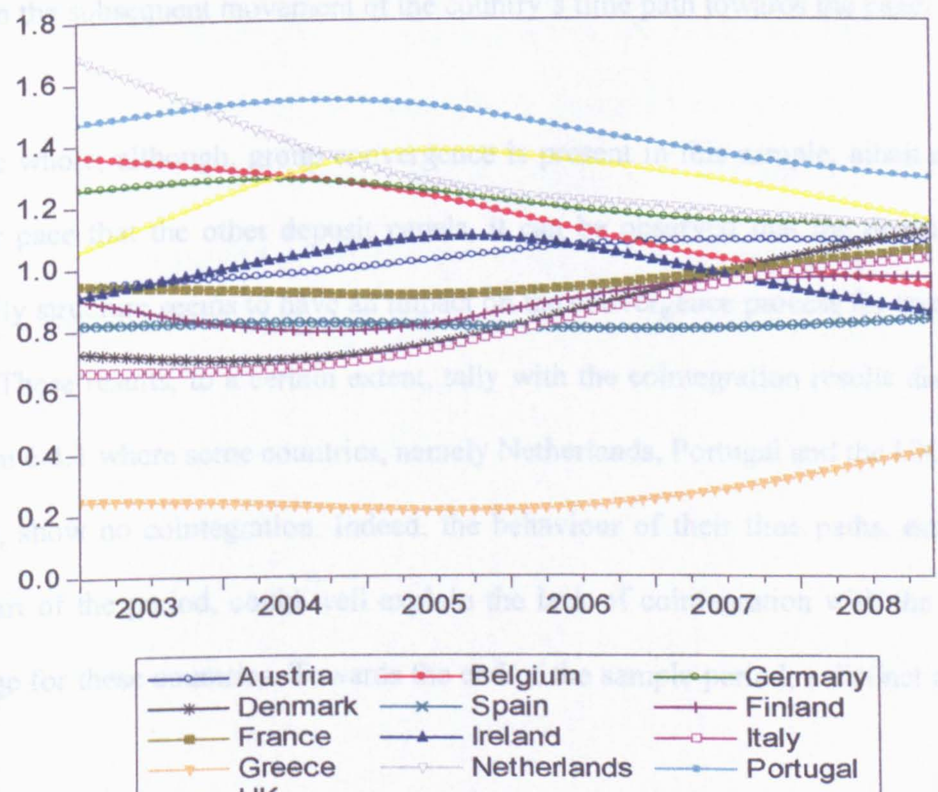


The transition curves depicted in Figure 6.11 show that all the countries in the sample have parallel convergence paths, except for the UK and Sweden. The transition curve for these two countries start far above the cross-section average and in the case of the UK, its transition coefficient actually moves away from one between 2003 and 2005 but after that, there is marked convergence towards the rest of the group of countries for both Sweden and UK. The reasons for such behaviour for these two countries have been discussed above and in Chapter 5.

6.9.2.3 Panel results for the deposit rates (over 2 years' maturity) for the period 2003-2008

Once more, the Phillips and Sul (2007) club clustering test reveal just one cluster comprising all 13 EU countries in the panel. Thus, the presence of just one cluster shows that convergence is also evident for the deposit rates with longer term maturities. However, the speed of convergence is much slower for this panel ($\hat{b}$ =0.348) compared to the other two deposit panels. Furthermore, when the transition path of each country is plotted (see Figure 6.12), greater insight into the convergence of deposit rates with longer maturities is revealed.

Figure 6.12 Transition paths for each country's deposit rates (over 2 years' maturity)



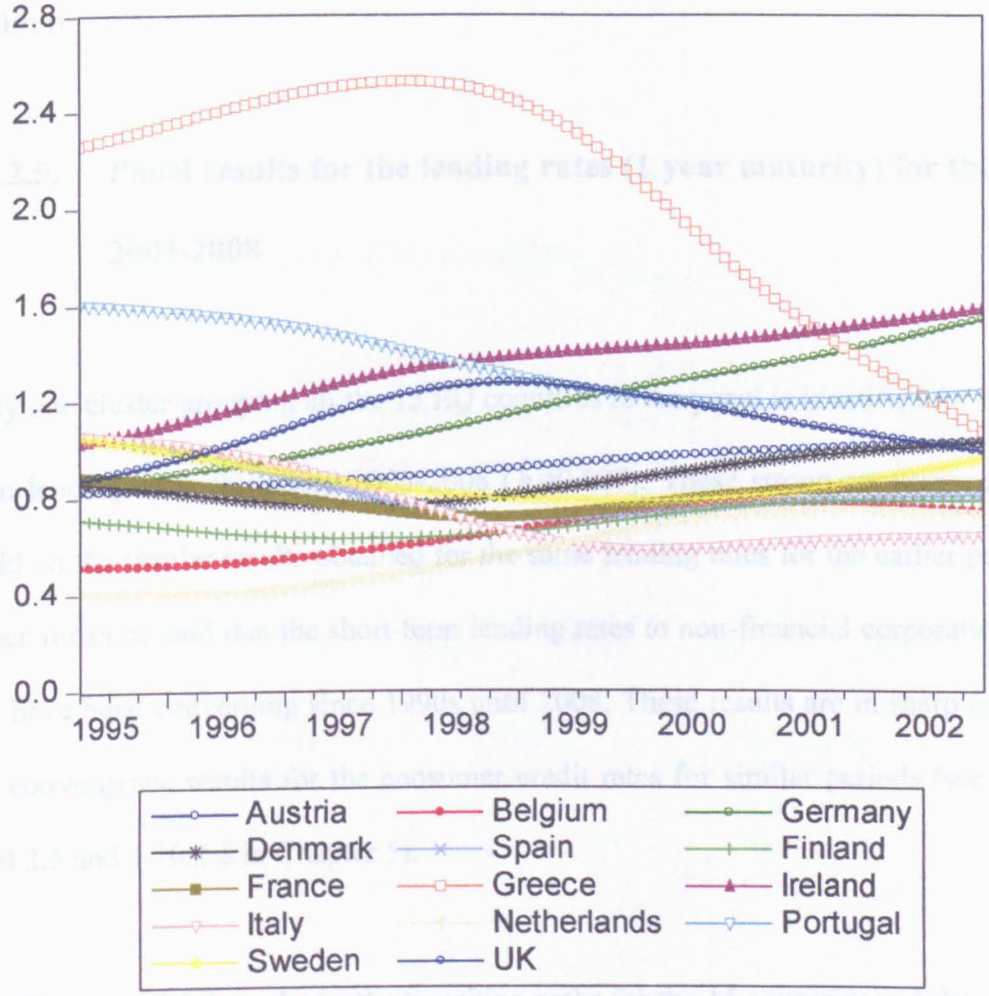
A visual display of the transition paths for each country's deposit rates with over 2 years' maturity shows that heterogeneity in the behaviour of all the 13 countries is evident (see Figure 6.12). All of the countries start at a different point in relation to the panel cross-section average but then slowly converge towards one. Greece is the only country that does not deviate much from its starting point of 0.2 for most of the period until 2005/6, after which a more convergent path is observed. Interestingly, in their study on EU bank competition and concentration for the period 1997-2003, Casu and Girardone (2006) rate the structure of the Greek banking market as a monopolist while the rest of the EU countries banking systems are categorised as monopolistic competition. The lack of competitive pressures in the Greek banking sector could explain the deviation of the country's transition coefficients from the panel average at the start of the period. However, the Greek banking sector has undergone several changes, most notably moving away from close ownership and management by the government in the late 1990s together with the implementation of several EU directives (Maniatis, 2006). The wave of consolidation and introduction of competition may well explain the subsequent movement of the country's time path towards the panel average.

On the whole, although, group convergence is present in this sample, albeit at a much slower pace that the other deposit panels, it can be observed that the duration of the maturity structure seems to have an impact on the convergence process for these deposit rates. These results, to a certain extent, tally with the cointegration results discussed in Section 6.4.1 where some countries, namely Netherlands, Portugal and the UK, amongst others, show no cointegration. Indeed, the behaviour of their time paths, especially at the start of the period, could well explain the lack of cointegration with the European average for these countries. Towards the end of the sample period, a distinct movement towards the panel cross-section average is clearly noticeable and this could well explain the positive convergence detected for the whole group.

6.9.2.4. Panel results for the short-term lending rates for the period 1995-2002

With regards to the short-term lending rates for the period 1995 to 2002, two sub-clubs have been identified by the Phillips and Sul (2007) club clustering test, each with 3 and 11 countries respectively. The first cluster consist of Germany, Greece and Ireland while the second cluster groups the majority of the countries, namely Austria, Belgium, Spain, Finland, France, Italy , Netherlands, Portugal Sweden, Denmark and UK. It is also observed that the speed of convergence within these two clusters vary significantly with a faster rate noted for the first cluster ($\hat{b}$=3.725) compared to the second cluster ($\hat{b}$=0.756). On the whole, the positive convergence results and the revelation that the majority of the EU countries in the sample belong to just one cluster provide strong support to the hypothesis that the convergence in the European retail banking was underway in the 1990s. Another note-worthy observation is that the non-euro area countries, i.e. Denmark, Sweden and UK belong to the same cluster. The same observation can be made for two members of the BENELUX group, namely Belgium, and the Netherlands (Luxembourg is not part of this sample due to a lack of data).

Figure 6.13 Transition paths for each country's short-term lending rates



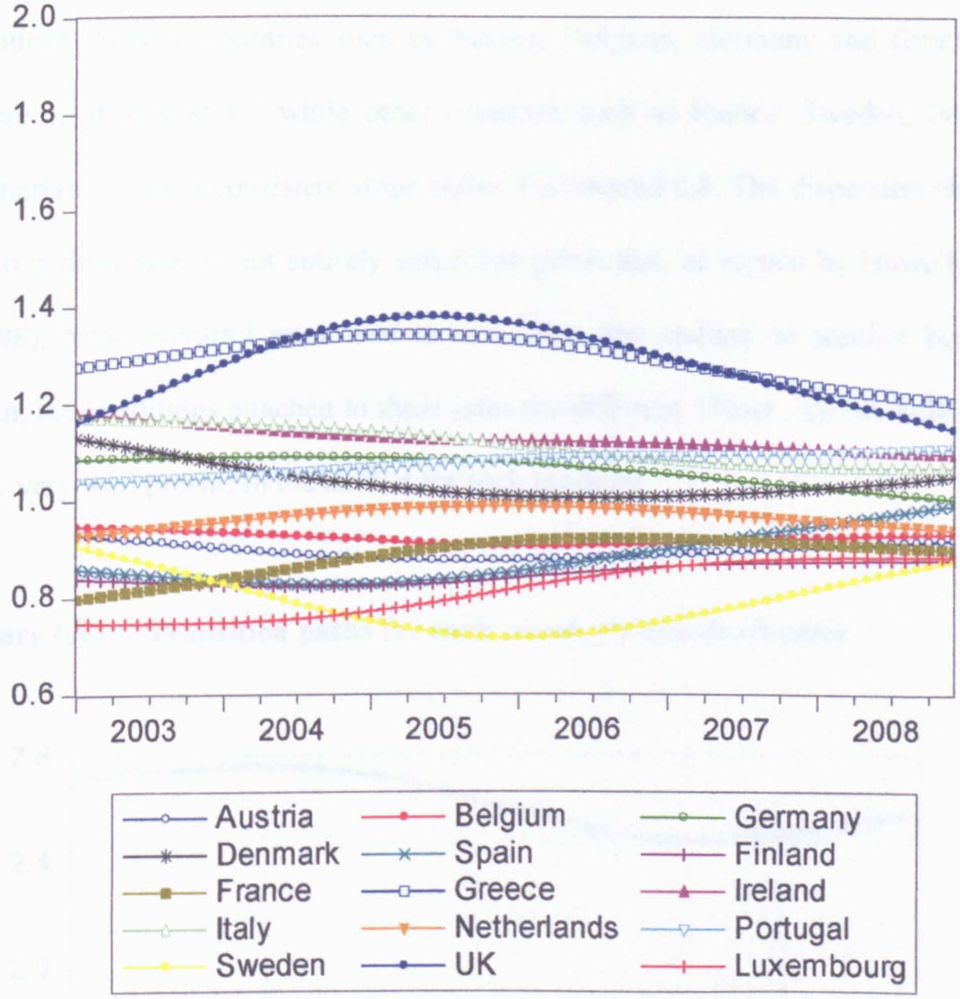
A visual inspection of the relative transition paths for each country, illustrated in Figure 6.13 above, show that all of the countries seem to follow a parallel path, except for Greece which starts way above the panel cross-section but then steadily moves towards the centre around late 1990s. This actually coincides with the start of the major deregulation in the Greek banking sector that was undertaken at the time. Moreover, the countries transition curves also seem to illustrate how the clusters have been formed. For instance, the paths for Germany and Ireland (both in the first cluster) certainly seem to have the same slope, i.e. the same growth rate of the transition coefficient relative to the cross-section average. In general, the clustering of the transition paths for the majority of the countries around the cross section average is more pronounced after the years 1998/99, which coincide with major events such as the FSAP and the launch of the Euro.

6.9.2.5. Panel results for the lending rates (1 year maturity) for the period 2003-2008

Only one cluster grouping all the 15 EU countries in the panel is identified for the short-term lending rates for period 2003-2008 ($\hat{b}$=0.827). These strong convergence results build on the similar results obtained for the same lending rates for the earlier period and hence it can be said that the short-term lending rates to non-financial corporations in the EU have been converging since 1990s until 2008. These results are in sharp contrast to the convergence results for the consumer credit rates for similar periods (see Sections 5.10.2.5 and 5.10.2.6 in Chapter 5).

The Figure 6.14 below shows the transition paths for the 15 countries and the clustering around one is clearly visible. Two countries, namely Greece and UK show a divergent behaviour at the start but around 2005, their paths change course and move towards the cross-section average. The other noticeably divergent country is Sweden which starts with a negative slope which becomes positive and parallel to the rest of the group around mid 2005. The reasons explaining the behaviour of the curves for these countries have already been presented in earlier Sections.

Figure 6.14 Transition paths for each country's lending rates (1 year maturity)

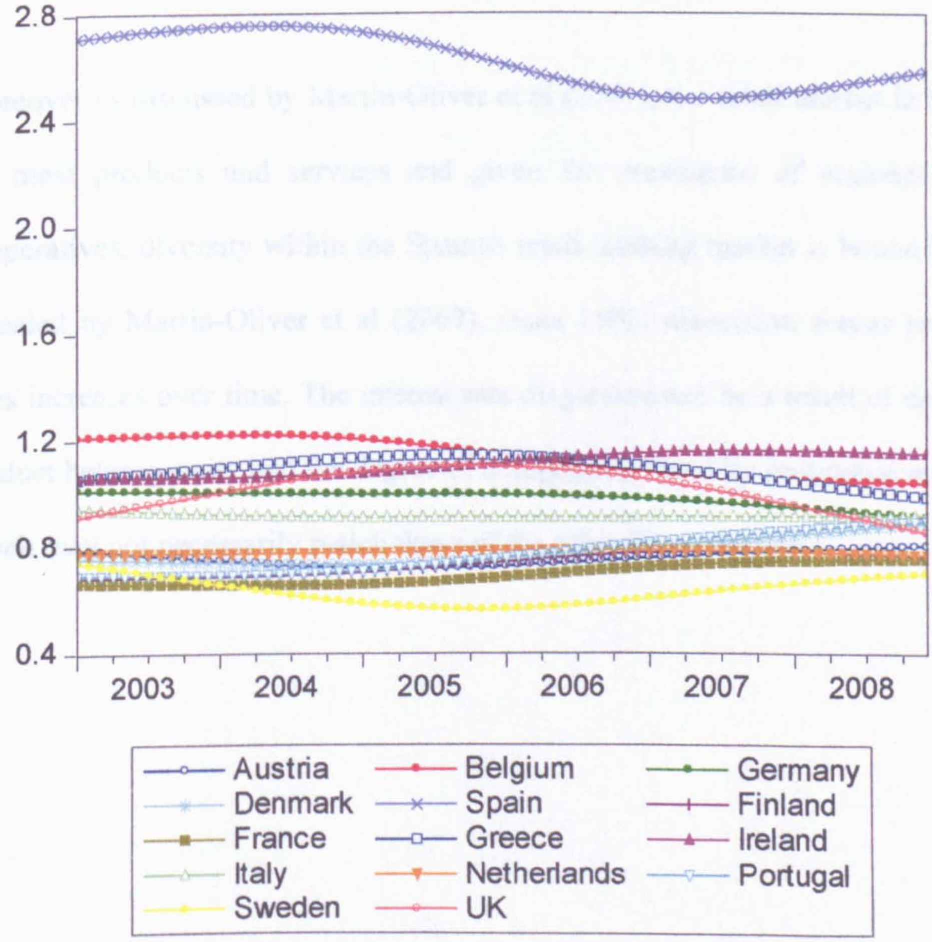


6.9.2.6 Panel results for the overdraft rates for the period 2003-2008

For the overdraft rates, as a whole group, the 14 countries in the panel do not converge, as discussed in Section 6.9.1 above. However, the club clustering tests show sub-club convergence is present for this panel. One cluster is identified grouping Austria, Belgium, Germany, Denmark, Finland, France, Greece, Italy, Netherlands, Portugal, Sweden and the UK ($\hat{b}$ =1.128). However, two divergent countries (Ireland and Spain) are also identified ($\hat{b}$ =-0.446).

As shown below in Figure 6.15, the time paths seem to indicate that most of the countries are following parallel paths although a clear divide can be seen between the countries. Several countries such as Austria, Belgium, Germany and Greece all start above 1, at around 1.2 while other countries such as France, Sweden, Portugal and Netherlands have a consistent slope below 1 at around 0.8. The dispersion observed for the overdraft rates is not entirely surprising given that, as argued by Howells and Bain (2008), bank overdraft rates tend to vary from one country to another because very often, the conditions attached to these rates are different. Hence, national characteristics may very well prevail in the market for such products.

Figure 6.15 Transition paths for each country's overdraft rates



Another notable observation from Figure 6.15 is that Spain is the only country to have a totally different path, which is confined to between 2.5 and 2.7. The reasons for Spain's transition path's behaviour can be explained as follows. Firstly, compared to the other 14 EU countries, the provision of overdraft facilities to enterprises constitutes a major source of retail banking business. For instance, the inquiry conducted by the European Commission (2006) on retail banking showed that based on 2004 figures, Spanish banks derives almost 32% of its gross income from small and medium enterprises (SMEs) from SME credit lines. In comparison, other EU Member States such as Austria (8.33%), Finland (7%,), France (8.82%,) and Germany (8.12%) derive much less income from SME credit lines. For these countries and most of the rest of the EU countries in the sample, the core product is current account. In contrast, Spain only derives around 9%[31] of its SME income from current accounts.

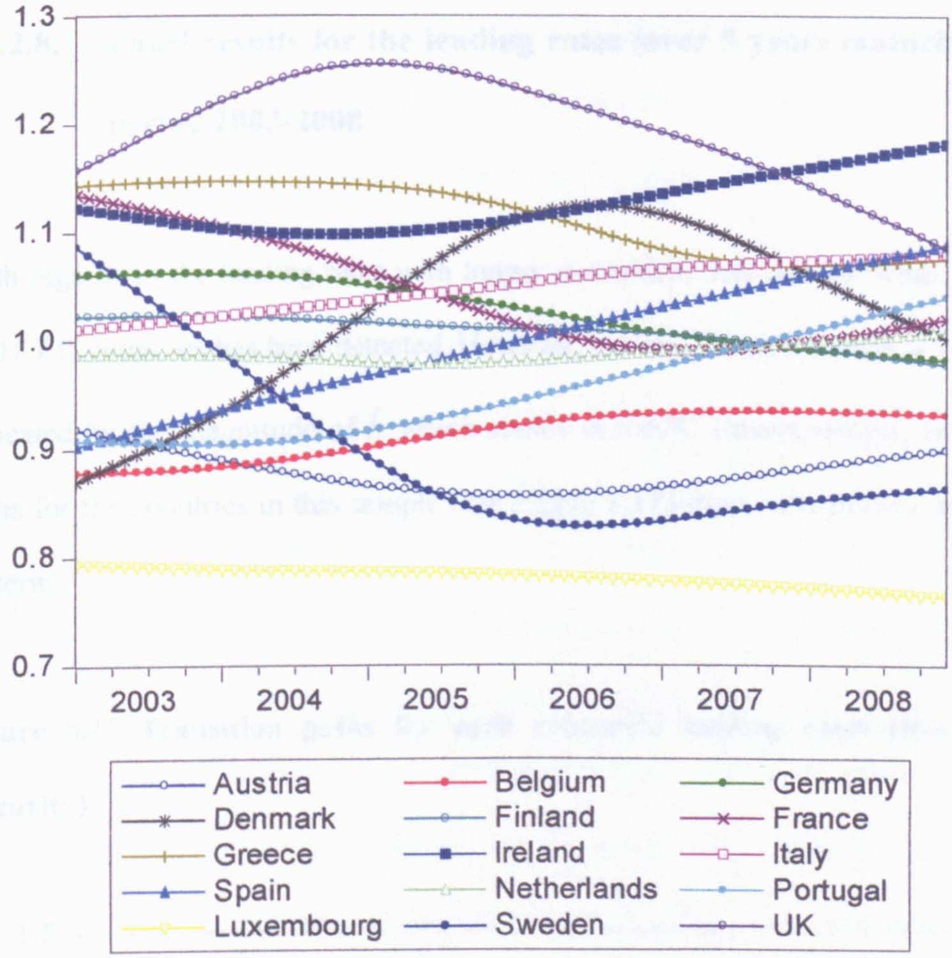
Moreover as discussed by Martin-Oliver et al (2007), the retail market in Spain is local for most products and services and given the prevalence of regional savings and cooperatives, diversity within the Spanish retail banking market is bound to be rife. As revealed by Martin-Oliver et al (2007), since 1993, dispersion across banks in credit lines increases over time. The interest rate dispersion can be a result of credit risks and product heterogeneity and the degree of competition faced by individual regional banks, which may not necessarily match those of the other EU countries.

[31] Based on 2004 figures (see European commission, (2006))

6.9.2.7. Panel results for the lending rates (1-5 years' maturity) for the period 2003-2008

As discussed in Section 6.9.1, the null of convergence for the whole panel for lending rates with 1-5 years maturity is rejected by the log t-test. As for the club clustering test results, they reveal a very heterogeneous market for such credit instruments. Two clusters are identified with 5 and 8 countries in each cluster respectively. The first group consists of Greece, Ireland, Spain, Portugal and UK ($\hat{b}$ =1.443) while the second cluster comprises Austria, Belgium, Germany, Denmark, Finland, France, Netherlands and Sweden ($\hat{b}$ =0.234). As observed by the magnitude of $\hat{b}$, this second cluster has a slow rate of convergence. The club clustering algorithm also identifies two divergent countries, namely, Italy and Luxembourg ($\hat{b}$ =-0.947). Incidentally, these two countries also belong to the group of countries that have no bivariate cointegrating relationship with the European average, as discussed in Section 6.4.2.

Figure 6.16 Transition paths for each country's lending rates (1-5 years' maturity)

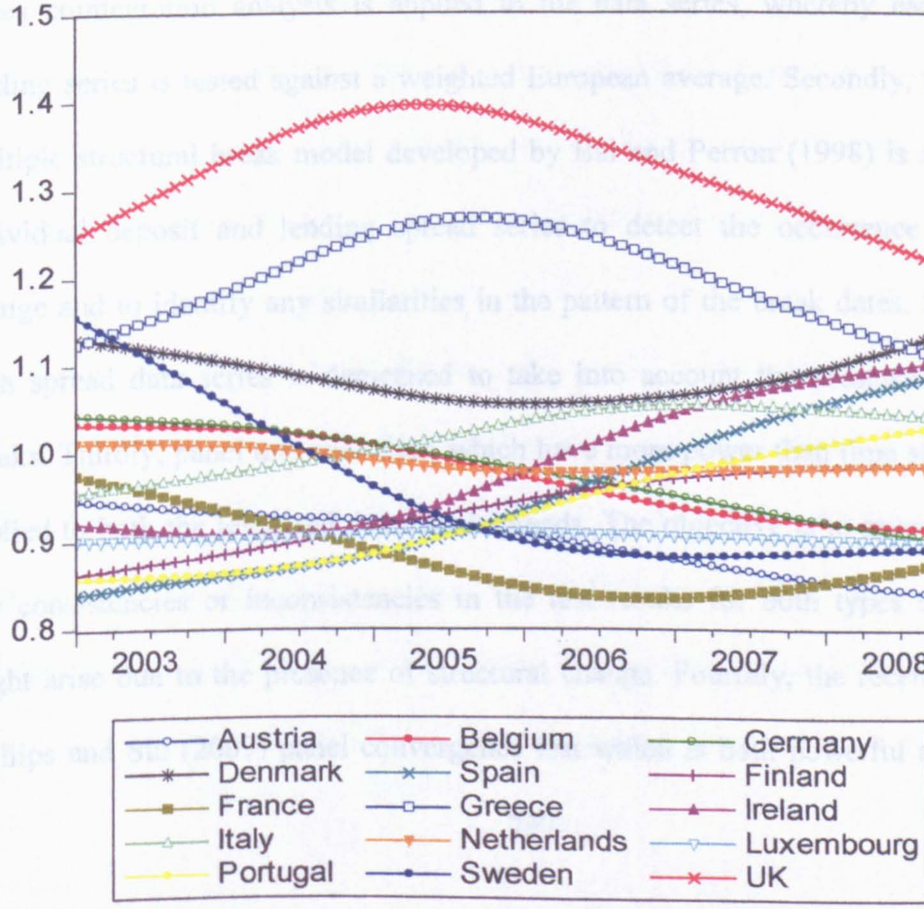


Along similar lines as the cointegration, log-t test and club clustering results, the transition curves charted above in Figure 6.16 also picture a high degree of heterogeneity among the countries' paths for these lending rates. Notably, it can be observed that the paths for Austria, France, Greece, Ireland, Sweden, and Germany all start with negative slopes which turn positive around 2006. UK's path on the other hand, starts by moving away from the cross-section average and then slowly converges to 1. Overall the results for this panel data set underpin the earlier observation that there seems to be more heterogeneous convergence for the lending rates with longer term maturities. The possible explanations and support underpinning this discovery has been discussed at length in Section 6.9.1.

6.9.2.8. Panel results for the lending rates (over 5 years maturity) for the period 2003-2008

With regards to the lending rates with longer maturities, only one sub-club, regrouping all 15 EU countries has been detected. However, the rate of convergence is very slow as indicated by the magnitude of $\hat{b}$ which stands at 0.028. Unsurprisingly, the transition paths for the countries in this sample (see Figure 6.17) show very diverse convergence patterns.

Figure 6.17 Transition paths for each country's lending rates (over 5 years' maturity)



The time paths reveal a tendency for most of the countries to have either a large negative slope or a positive one above the cross-section average of one. The heterogeneous behaviour of the countries' transition paths for the panel of lending rates with over 5 years' maturities emphasise the earlier log *t*-test results which point to a less integrated retail banking market for instruments with longer term maturities. As discussed in Section 6.9.1, there are both theoretical and anecdotal evidence that can explain such results.

6.10 Conclusions

The aim of this chapter has been to conduct an empirical investigation of the integration process in the EU retail banking sector by analysing monthly deposit and lending rates to non-financial corporations for the period ranging from 1991 to end 2008. An important contribution in this chapter is the application of methodologies that have not, so far, been employed in the literature on European banking integration. Firstly, time series cointegration analysis is applied to the data series, whereby each deposit or lending series is tested against a weighted European average. Secondly, the stochastic multiple structural break model developed by Bai and Perron (1998) is applied to the individual deposit and lending spread series to detect the occurrence of structural change and to identify any similarities in the pattern of the break dates. Subsequently, each spread data series is demeaned to take into account the presence of structural breaks. Thirdly, panel unit root tests, which have more power than time series tests, are applied to both the level and demeaned spreads. The objective is to reveal and explore any consistencies or inconsistencies in the test results for both types of data which might arise due to the presence of structural change. Fourthly, the recently developed Phillips and Sul (2007) panel convergence test which is both powerful and flexible is applied to the deposit and lending data sets. The benefit of using this methodology is that firstly it provides evidence on both the degree and speed of convergence and secondly it identifies sub-group convergence. In addition, this convergence test advocates the use of filtered data which is rendered free from any cycle components and is thus applied to filtered level deposit and lending data.

The main findings of this chapter are as follows. Firstly, the cointegration result point to a higher level of convergence in the deposit market compared to the lending one. In general, these results are in line with the previous existing literature that shows a segmented retail banking sector, especially in the 1990s and early 2000s.

Secondly, the stochastic structural break test analysis has revealed the presence of mostly 3 to 5 breaks that occur in the period 1991 to 2002 and mostly 2 breaks for the period 2003-2008. Furthermore, it can be observed that the timing of the break dates for all the 8 data sets tested are clearly clustered around specific dates and years which match key events such as the launch of the Single Market and the adoption of key directives, which are likely to have had an impact on the European retail banking sector. Hence, it can be claimed that the deposit and lending spread series within the EU retail banking sector appear to respond simultaneously to common shocks.

Thirdly, an econometric result that warrants special mention is the empirical results obtained under the panel unit root tests which have been applied to the demeaned spreads. Here, it is noted that all the demeaned spread panels consistently show strong evidence of integration (even at the 1% significance level) in both the deposit and lending markets for both the 1990s and the more recent period, 2003-2008. This is in sharp contrast to the results obtained for the deposit and lending level spread panels whereby the hypothesis of convergence is rejected for all panels except for one[32]. Hence, the presence of retail banking integration is clearly evident when data that allows for structural break, are used. This reinforces the argument that the presence of significant structural breaks can lead to wrong inferences being drawn from panel unit root tests.

Fourthly, The Phillips and Sul (2007) log *t*-test do not unequivocally supports the process of group integration in the European retail deposit and lending market as observed under the panel unit root analysis. However, the club clustering test do reveal that convergence is indeed present is all the 8 panels but paints a more heterogeneous picture of retail banking integration for certain products. Given that the Phillips and Sul convergence methodology is better at capturing long-run equilibrium that the panel unit root tests and also provides informative on the degree and speed of convergence, the conclusions drawn in this research are thus based on the Phillips and Sul test results.

On the whole, it can be observed that close convergence is evident in the short-term deposit and lending market and that the integration process started well in the 1990s for the short term loans to non-financial corporations. These results are in contrast to the consumer credit rates whereby, as discussed in the previous Chapter, the null of group convergence is actually rejected. As for the remaining data sets, the club clusters are less concentrated and some divergent units have also been identified. This is particularly apparent with the deposit and lending rates with the medium to long term maturities. This fact is also highlighted in the visual depiction of each country's transition curve for these panel sets. Therefore, it can be stated that heterogeneity is still present within the European retail banking market for instruments with longer term maturities. These

[32] The 1990s lending spreads based on the CIPS results.

results could well reflect market expectations with regards to inflation, country-risks, growth prospects, fiscal policies, public debt, the government's credibility in managing public finances and other factors which are embedded in the expectations and liquidity preference theories. In fact, the importance of liquidity and credit risks has been particularly stressed during the recent financial turmoil. Thus, the evidence uncovered through the application of these 3 methodologies point to an integrated retail banking sector for non-financial corporations, provided we allow for structural breaks in the deposit and lending spreads and employ panel tests which have more power than the time series tests and also allow for heterogeneity across countries.

Appendix 6A: Additional information on the data series for the Non-financial corporations' sector

1. Short-term lending rates to enterprises [1991-2002]

Data description: Short-term lending rates to enterprises
Countries: Austria, Belgium[33], Germany, Spain, Finland[34], France, Greece, Ireland[35], Italy[36], Netherlands, Portugal and Sweden[37]
Source: ECB Database [N4, N4-1,N4-2, N5]

Data description: Average lending rate from Danmarks National Bank reports and accounts (91-95)
and Datastream (95-02)
Country: Denmark[38]
Source: Datastream and Danmarks Nationalbank

Data description: "IMF min base lending rate (clearing banks) [91-98]" merged with "BOE average lending rate to Non-financial corporations [99-2002]"
Country: UK
Source: IMF and Bank of England

2. Bank overdrafts to non-financial corporations [2003-2008]

Data description: Bank overdrafts (i.e. debit balances on current accounts), Total maturity, New business coverage, in Euro
Countries: Austria, Belgium, Germany, Denmark (Danish Krone), Spain, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal
Source: ECB Database

Data description: "Lending rates to NFC on transactions accounts (2003-2005)" merged with "ECB Bank overdrafts [Aug 2005- Dec 08]"
Country: Sweden
Source: Riksbank Database / ECB Database

Data description: Monthly average of UK resident banks' sterling weighted average interest rate, overdrafts to private non-financial corporations (in percent) not seasonally adjusted
Country: UK
Source: Bank of England

3. Loans with up to 1 year maturity to Non-financial corporations [2003-2008]

Data description: Loans, Up to 1 year maturity, Outstanding amount business coverage, in Euro

[33] 6 months' maturity
[34] Medium term lending rates [N5]
[35] Overdraft and term loans up to 1 year
[36] Minimum rate on loans to firms up to 18 months' maturity
[37] Quarterly data converted to monthly data using the cubic spline method
[38] Quarterly data converted to monthly data using the cubic spline method

Countries: Austria, Belgium, Denmark (Danish krone), Germany, Italy, Ireland, Finland, France, Greece, Luxembourg, Netherlands, Portugal, Spain
Source: ECB Database

Data description: "MFIs' lending rates, period ending stock to non-financial corporations [2003-2005]" merged with "ECB loan rates with up to 1 year maturity, in Swedish Krona, [2005-2008]"
Country: Sweden[39]
Source: Riksbank database / ECB Database

Data description: "Monthly average of UK resident banks' sterling weighted average interest rate, other loans to private non-financial corporations (in percent) not seasonally adjusted [03-04]2 merged with "Monthly average of UK resident banks' sterling weighted average interest rate - other loans with an initial fixation <=1yr to private non-financial corporations (in percent) not seasonally adjusted [04-08]"
Country: UK
Source: Bank of England Statistical Database

4. Loans with over 1 and up to 5 years maturity to Non-financial corporations [2003-2008]

Data description: Loans other than bank overdrafts [A20-A2Z] with over 1 and up to 5 years maturity, up to and including EUR 1 million amount, New business coverage, in Euro
Countries: Austria, Belgium, Denmark (Danish Krone), Germany, Finland, France, Greece, Ireland, Italy, Luxembourg[40], Portugal[41], Spain, Netherlands
Source: ECB Database

Data description: "Banks' total lending rates to NFC rates, period ending stock, to non-financial corporations [2003-2005 / quarterly data converted to monthly data]" merged with "ECB lending rates with 1-5 years, new business (August 2005-Dec 08)"
Country: Sweden
Source: Riksbank Database / ECB Database

Data description: "Monthly average of UK resident banks' sterling weighted average interest rate, other loans to private non-financial corporations (in percent) not seasonally adjusted (Jan –Dec 03)" merged with "Monthly average of UK resident banks' sterling weighted average interest rate - other loans, new advances, initial fixation >1yr<=5yrs to private non-financial corporations (in percent) not seasonally adjusted (Jan 04- Dec 08)"
Country: UK
Source: Bank of England Statistical Database

5. Loans with over 5 years maturity to Non-financial corporations [2003-2008]

Data description: Loans other than bank overdrafts [A20-A2Z] with over 5 years' maturity, up to and including EUR 1 million amount, New business coverage, in Euro

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[39] Quarterly data has been converted to monthly data with the Cubic spline method
[40] Loans with 1-5 maturity, outstanding amount business coverage
[41] Loans with 1-5 maturity, outstanding amount business coverage

Countries: Austria, Belgium, Germany, Denmark (Danish Krone), Spain, Finland, France, Greece, Ireland, Italy, Luxembourg[42], Portugal[43], Netherlands
Source: ECB Database

Data description: "Banks' total lending rates to NFC, period ending stock, to non-financial corporations [2003-2005 / quarterly data converted to monthly data]" merged with "ECB lending rates with over 5 years maturity (August 2005-Dec 08)"
Country: Sweden
Source: Riksbank Database / ECB Database

Data description: "Monthly average of UK resident banks' sterling weighted average interest rate, other loans to private non-financial corporations (in percent) not seasonally adjusted (Jan –Dec 03)"; merged with "Monthly average of UK resident banks' sterling weighted average interest rate - other loans, new advances, initial fixation >5yrs to private non-financial corporations (in percent) not seasonally adjusted"
Country: UK
Source: Bank of England Statistical Database

6. Deposits with up to 1 year maturity to Non-financial corporations [2003-2008]

Data description: Deposits with up to 1 year maturity, New business coverage, in Euro
Countries: Belgium, Austria, Denmark (Danish krone), Germany, Spain, Finland, France, Greece, Ireland[44], Luxembourg, Netherlands, Portugal
Source: ECB Database

Data description: Interest rate on deposits with agreed maturity to non-financial corporations, New business coverage
Country: Italy
Source: Bank of Italy Database

Data description: "Banks' average deposit rates, period ending stock, to non-financial corporations [2003-2005]" merged with "ECB - Deposits with up to 1 year maturity, New business coverage, in Swedish Krona, [2005-2008]"
Country: Sweden
Source; Riksbank Database / ECB Database

Data Description: "Monthly average of UK resident banks' sterling weighted average interest rate, interest bearing sight deposits from private non-financial corporations (in percent) not seasonally adjusted [03-04]" merged with "Monthly average of UK resident banks' sterling weighted average interest rate - time deposits with fixed original maturity <=1 year from private non-financial corporations (in percent) not seasonally adjusted ([04-08]"
Country: UK
Source: Bank of England Statistical Database

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42 Loans with over 5 yrs maturity, outstanding amount business coverage
43 Loans with over 5 yrs maturity, outstanding amount business coverage
44 Deposits with up to two years maturity, Outstanding amount business coverage

7. Deposits with over 1 and up to 2 years maturity to Non-financial corporations [2003-2008]

Data description: Deposits with over 1 and up to 2 years maturity, New business coverage, in Euro
Countries: Austria, Germany, Spain, France
Source: ECB Database

Data description: Deposits with up to two years maturity, Outstanding amount business coverage, in Euro
Countries: Belgium, Luxembourg, Netherlands, Portugal, Greece, Finland, Denmark (Danish Krone), Ireland, Italy[45]
Source: ECB Database

Data description: "Deposit rates with agreed maturity to non-financial corporations (Riksbank jan 03-Aug 05) [quarterly data converted to monthly data using Cubic Spline Method]" merged with "ECB deposits with 1-2 years maturity, new business coverage [Aug 05-Dec 08]"
Country: Sweden
Source: Riksbank Database / ECB Database

Data description: "Monthly average of UK resident banks' sterling weighted average interest rate, time deposits from private non-financial corporations (in percent) not seasonally adjusted (Jan –Dec 03)2 merged with "Monthly average of UK resident banks' sterling Weighted average interest rate - time deposits with fixed original maturity >1 year from private non-financial corporations (in percent) not seasonally adjusted (Jan 04-08)"
Country: UK
Source: Bank of England Statistical Database

8. Deposits with over 2 years maturity to Non-financial corporations [2003-2008]

Data description: Deposits with over 2 years' maturity, New business coverage, in Euro
Countries: Austria, Germany, Denmark, Spain, Finland, France, Italy[46]
Source: ECB Database

Data description: Deposits with over 2 years' maturity, Outstanding amount business coverage, in Euro
Countries: Belgium, Greece, Ireland, Netherlands, Portugal
Source: ECB Database

Data description: Monthly average of UK resident banks' sterling weighted average interest rate, time deposits from private non-financial corporations, total maturity (BOE)
Country: UK
Source: Bank of England Statistical Database

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[45] Deposits with total maturity, outstanding amount business coverage.
[46] Deposits with total maturity, new business coverage

Appendix 6B

Table 6B.1: ADF unit root tests for the data series for the Non-financial sector

Country	Short-term Lending rates 1991-2002		Bank overdrafts 2003-2008		Lending rates (1yr) 2003-2008		Lending rates (1-5yrs) 2003-2008	
	T-statistic for level	T-statistic for 1st difference	T-statistic for level	T-statistic for 1st difference	ADF t-statistic for level	ADF t-statistic for 1st difference	ADF t-statistic for level	ADF t-statistic for 1st difference
Austria [L=1,1,1,1]	-2.460163	-3.509903	-0.324902	-4.126897	-0.905607	-3.303450	-1.163356	-6.833888
Belgium [L=7,1,1,1]	-1.965490	-3.185679	-2.367495	-8.839365	-1.023513	-5.064233	-1.326572	-2.587731
Germany [L=11,1,1,1]	-2.337274	-3.134497	-1.395134	-2.403200	-1.443083	-2.079784	-1.085955	-4.308450
Denmark [L=10,1,1,1]	-1.491097	-3.933820	1.991302	-4.254692	0.128663	-4.953588	-1.762414	-9.058413
Spain [L=9,4,1,1]	-1.324669	-3.583254	-1.056772	-6.471645	-1.030950	-1.800405	-0.751147	-3.867789
Finland [L=10,1,1,1]	-2.326288	-3.489951	-1.290107	-1.112318	-1.554642	-2.507818	-1.315106	-6.172819
France [L=9,1,1,1]	-1.298937	-3.773854	-0.365257	-5.774169	-0.782570	-5.157188	-0.469402	-5.633304
Greece [L=4,1,1,1]	-0.311026	-5.495875	-1.632784	-3.370906	-0.601323	-3.136277	-1.812063	-8.909798
Ireland [L=7,1,1,1]	-1.652703	-4.256577	-0.809896	-4.337933	-1.476305	-0.913336	-1.421524	-6.388787
Italy [L=8,1,1,1]	-0.983244	-3.292100	-1.138833	-3.950899	-0.668301	-3.750553	-0.630983	-6.430712
Luxembourg [L=-,-,1,1]	-	-	-	-	-0.833823	-4.883258	-1.573555	-6.876538
Netherlands [L=2,1,1,1]	- 1.575982	-3.961533	-1.468975	-4.485294	-0.985815	-4.388775	-1.795514	-3.870438
Portugal [L=2,1,1,1]	-2.806563	-4.941878	-0.316354	-4.738396	-0.399648	-3.752317	-1.261599	-2.865155
Sweden [L=12,2,6,1]	-2.296745	-2.940374	-2.299398	-2.272074	-2.144874	-1.182730	-1.712417	-1.982707
UK [L=2,1,1,1]	-2.487600	-4.449804	-0.744292	-2.588694	-1.824589	-2.562942	-2.206012	-7.781921
EU average rates [L=8,1,1,1]	-1.661676	-3.417308	-1.426346	-6.168451	-2.235879	-1.683653	-1.061181	-4.364887

Notes a) The ADF tests were conducted in Eviews 6 and the ADF model with intercept is used. b) The selection of the lag length is based on the t-recursive method with the maximum lag order set at 12 for the 1991-2002 series and at 6 for the 2003-2008 series. c) The corresponding lag length is indicated next to each country. d) For the1991- 2002 data series, the 5% ADF critical value is -2.88 while for the 2003-2008 series, the 5% ADF critical value is -2.90 and the 10% ADF critical value is -2.59.

Table 6B.2: ADF unit root tests for the data series for the Non-financial sector

Country	Lending rates (>5yrs) 2003-2008		Deposit rates (1yr) 2003-2008		Deposit rates (1-2yrs) 2003-2008		Deposit rates (>2yrs) 2003-2008	
	T-statistic for level	T-statistic for 1st difference	T-statistic for level	T-statistic for 1st difference	ADF t-statistic for level	ADF t-statistic for 1st difference	ADF t-statistic for level	ADF t-statistic for 1st difference
Austria [L=5,1,1,3]	-1.119849	-4.968098	-1.324688	-2.777185	-0.825196	-7.280321	-0.954818	-7.265048
Belgium [L=1,3,1,2]	-1.767755	-5.164915	-2.133979	-0.328013	-1.213288	-2.773829	-2.646924	-4.423847
Germany [L=6,3,6,2]	-1.203159	-3.192277	-2.543336	0.025480	-0.226506	-4.011858	-1.543503	-6.349827
Denmark [L=3,1,1,2]	-0.533353	-3.468424	0.560423	-5.718529	2.037588	-4.085993	0.107713	-4.864331
Spain [L=1,1,1,3]	-0.548535	-6.851288	-0.962713	-3.218730	0.036662	-7.351154	-1.246004	-6.026762
Finland [L=1,1,4,6]	-1.299951	-6.554851	-1.777644	-0.071959	-1.922068	-1.210963	-1.217847	-2.992699
France [L=1,1,6,5]	-0.534426	-4.784324	-1.386314	-3.759269	-0.572028	-3.501121	-0.318190	-4.469217
Greece [L=2,1,1,5]	-2.276516	-7.991867	0.437150	-6.710910	1.598373	-4.752723	0.625012	-4.348537
Ireland [L=1,3,3,1]	-0.850628	-4.918609	-2.470399	-0.584937	-2.470399	-0.584937	-1.461472	-7.175576
Italy [L=2,1,3,1]	-1.204264	-3.106145	-1.096509	-3.762331	-1.791919	-1.620727	-1.092462	-3.741462
Luxembourg[L=1,1,1]	-1.103530	-3.476641	-1.117217	-3.336813	-0.969288	-3.103044	-	-
Netherlands [L=3,3,6,1]	-1.355138	-2.991869	-2.168101	-0.152166	-1.444281	-1.495565	-1.908283	-5.693552
Portugal [L=1,1,1,4]	-0.942150	-3.182387	-0.626058	-4.880316	0.381433	-4.337714	0.556672	-4.536848
Sweden [L=1,4,1]	-1.974824	-2.616169	-2.079898	-0.899379	-1.770366	-3.019175	-	-
UK [L=5,1,1,4]	-2.009138	-4.435570	-1.690385	-1.092175	-1.625461	-4.988482	-1.231568	-0.545657
EU average rates [L=1,1,1,1]	-1.229506	-4.957327	-1.621574	-1.810143	-0.771850	-3.620758	-0.963889	-4.875717

Notes a) The ADF tests were conducted in Eviews 6 and the ADF model with intercept is use. b) The selection of the lag length is based on the t-recursive method with the maximum lag order set at 6 and the corresponding lag length is indicated next to each country. c) The 5% ADF critical value is -2.90 and the 10% ADF critical value is -2.59

Table 6C.1 Johansen cointegration tests results for each EU country's rate and the corresponding European weighted average rate

Country	Hypothesis	Deposit rates: 1 year maturity + 1-2 years' maturity		Lending rates: Short term maturity (91-02) + overdraft rates (03-08)	
		Deposit (1yr) 2003-2008	**Deposit (1-2yrs) 2003-2008**	**Lending 1991-2002**	**Lending (Overdraft rates) 2003-2008**
	Trace test				
Austria	H0: r=0	36.75818**	19.20051	26.11353**	7.991241
	H1: r≤1	10.61615*	1.977692	5.295109	1.882701
Lag order					
L_D=11,2	**Max-Eigen**				
L_L=4,4	H0: r=0	26.14203**	17.22282*	20.81842**	6.108540
	H1: r≤1	10.61615*	1.977692	5.295109	1.882701
	Trace test				
Belgium	H0: r=0	17.38540	16.70995	8.130331	12.85809
	H1: r≤1	5.585968	5.114719	2.621138	2.135631
Lag order					
L_D=11,3	**Max-Eigen**				
L_L=4,5	H0: r=0	11.79943	11.59523	5.509193	10.72245
	H1: r≤1	5.585968	5.114719	2.621138	2.135631
	Trace test				
Germany	H_0: r=0	27.24496**	19.95412	11.18940	14.48080
	H_1: r≤1	6.714691	3.376894	3.706617	3.048942
Lag order					
L_D=11,3	**Max-Eigen**				
L_L=7,1	H_0: r=0	20.53027**	16.57723*	7.482787	11.43186
	H_1: r≤1	6.714691	3.376894	3.706617	3.048942
	Trace test				
Denmark	H_0: r=0	7.349603	20.79195*	12.54260	19.77503
	H_1: r≤1	3.027186	1.336213	1.523597	4.271252
Lag order					
L_D=4, 1	**Max-Eigen**				
L_L=11,2	H_0: r=0	4.322417	19.45574*	11.01900	15.50377
	H_1: r≤1	3.027186	1.336213	1.523597	4.271252
	Trace test				
Spain	H_0: r=0	20.74775*	32.39619**	20.86724*	25.79048**
	H_1: r≤1	5.763795	1.227330	6.436823	9.691816*
Lag order					
L_D=4, 1	**Max-Eigen**				
L_L=5,6	H_0: r=0	14.98396	31.16886**	14.43041	16.09866*
	H_1: r≤1	5.763795	1.227330	6.436823	9.691816*

Table 6C.1. Cont'd

Country	Hypothesis	Deposit rates: 1 year maturity+ 1-2 years' maturity		Lending rates: Short term maturity (91-02) + overdraft rates (03-08)	
		Deposit 1yr 2003-2008	Deposit (1-2yrs) 2003-2008	Lending 1991-2002	Overdraft 2003-2008
	Trace test				
Finland	H_0: r=0	23.68769*	23.56056*	17.44001	17.12704
	H_1: r≤1	3.224907	5.333346	6.334262	7.283624
Lag order					
L_D=12,3	**Max-Eigen**				
L_L=11,5	H_0: r=0	20.46278**	18.22721*	11.10575	9.843418
	H_1: r≤1	3.224907	5.333346	6.334262	7.283624
	Trace test				
	H_0: r=0	30.90233**	28.17829**	15.86079	21.42608**
France	H_1: r≤1	9.802938*	1.407631	5.117522	1.556435
Lag order	**Max-Eigen**				
L_D=10,1	H_0: r=0	21.09939**	26.77066**	10.74327	19.86965**
L_L=4,2	H_1: r≤1	9.802938*	1.407631	5.117522	1.556435
	Trace test				
	H_0: r=0	28.23208**	34.59253**	24.50346*	17.45202
Greece	H_1: r≤1	3.564282	4.033435	4.834839	2.914927
Lag order	**Max-Eigen**				
L_D=2,1	H_0: r=0	24.66780**	30.55910**	19.66862*	14.53710
L_L=5,4	H_1: r≤1	3.564282	4.033435	4.834839	2.914927
	Trace test				
	H_0: r=0	13.56486	25.45503**	18.63655	14.54038
Ireland	H_1: r≤1	5.062675	5.631348	5.247725	4.487031
Lag order	**Max-Eigen**				
L_D=12,4	H_0: r=0	8.502186	19.82368*	13.38883	10.05335
L_L=7,4	H_1: r≤1	5.062675	5.631348	5.247725	4.487031
	Trace test				
	H_0: r=0	24.65126*	11.10270	11.05512	22.55223*
Italy	H_1: r≤1	8.191635	3.302581	3.339331	2.045998
Lag order	**Max-Eigen**				
L_D=12,3	H_0: r=0	16.45963*	7.800115	7.715786	20.50623*
L_L=7,1	H_1: r≤1	8.191635	3.302581	3.339331	2.045998

Table 6C.1. Cont'd

Country	Hypothesis	Deposit rates: 1 year maturity+ 1-2 years' maturity		Lending rates: Short term maturity (91-02) + overdraft rates (03-08)	
		Deposit 1yr 2003-2008	**Deposit (1-2yrs) 2003-2008**	**Lending 1991-2002**	**Overdraft 2003-2008**
	Trace test			-	-
Luxembourg	H_0: r=0	27.19475**	12.60337		
	H_1: r≤1	7.965014	3.673998		
Lag order					
L_D=12,2	**Max-Eigen**				
	H_0: r=0	19.22974*	8.929371		
	H_1: r≤1	7.965014	3.673998		
	Trace test				
	H_0: r=0	23.49965*	15.21724	12.74309	14.12422
Netherlands	H_1: r≤1	7.918791	2.319118	2.793411	3.174579
Lag order	**Max-Eigen**				
L_D=12,2	H_0: r=0	15.58086	12.89812	9.949679	10.94964
L_L=8,4	H_1: r≤1	7.918791	2.319118	2.793411	3.174579
	Trace test				
	H_0: r=0	25.05300*	20.70281*	30.14726**	9.653852
Portugal	H_1: r≤1	10.16000*	1.889391	11.61523*	3.257238
Lag order	**Max-Eigen**				
L_D=11,2	H_0: r=0	14.89300	18.81342*	18.53204*	6.396614
L_L=4,4	H_1: r≤1	10.16000	1.889391	11.61523*	3.257238
	Trace test				
	H_0: r=0	30.13836**	17.65325	17.48499	7.195739
Sweden	H_1: r≤1	10.35499*	6.383468	5.905795	1.562953
Lag order	**Max-Eigen**		11.26978		
L_D=11,4	H_0: r=0	19.78337*	6.383468	11.57919	5.632786
L_L=11,4	H_1: r≤1	10.35499*		5.905795	1.562953
	Trace test				
	H_0: r=0	27.62252**	15.39501	14.68356	18.19577
UK	H_1: r≤1	8.174775	3.182537	4.539084	4.090135
Lag order	**Max-Eigen**				
L_D=11,3	H_0: r=0	19.44775*	12.21247	10.14447	14.10563
L_L=9,4	H_1: r≤1	8.174775	3.182537	4.539084	4.090135

Table 6C.2 ***Johansen cointegration tests results for each EU country's rate and the corresponding European weighted average rate***

Country	Hypothesis	Deposit rates: >2yrs maturity	Lending rates: 1yr maturity, 1-5 yrs maturity, over 5 years maturity		
		Deposit (>2yrs) 2003-2008	**Lending (1yr) 2003-2008**	**Lending (1-5yrs) 2003-2008**	**Lending(>5yrs) 2003-2008**
Austria	**Trace test**				
	H0: r=0	32.75460**	12.76347	20.98248*	27.64574**
Lag order	H1: $r\leq1$	1.041850	3.965651	2.098272	1.582748
L_D=1					
L_L=1,2,1	**Max-Eigen**				
	H0: r=0	31.71275**	8.797824	18.88421*	26.06299**
	H1: $r\leq1$	1.041850	3.965651	2.098272	1.582748
	Trace test				
Belgium	H0: r=0	25.72636**	8.614164	11.98053	12.52620
	H1: $r\leq1$	3.105491	2.567777	3.009583	3.174540
Lag order					
L_D=1	**Max-Eigen**				
L_L=2,2,2	H0: r=0	22.62087**	6.046387	8.970946	9.351664
	H1: $r\leq1$	3.105491	2.567777	3.009583	3.174540
	Trace test				
Germany	H_0: r=0	22.34194*	9.243657	14.00191	10.58902
	H_1: $r\leq1$	1.136292	2.219291	1.305299	1.710446
Lag order					
L_D=1	**Max-Eigen**				
L_L=2,1,1	H_0: r=0	21.20565**	7.024367	12.69661	8.878570
	H_1: $r\leq1$	1.136292	2.219291	1.305299	1.710446
	Trace test				
Denmark	H_0: r=0	32.06488**	19.40041	8.786991	10.15165
	H_1: $r\leq1$	0.697372	3.620693	2.513785	3.842963
Lag order					
L_D=1	**Max-Eigen**				
L_L=2,2,4	H_0: r=0	31.36750**	15.77972	6.273206	6.308687
	H_1: $r\leq1$	0.697372	3.620693	2.513785	3.842963
	Trace test				
Spain	H_0: r=0	32.69933**	17.19691	6.097031	11.54373
	H_1: $r\leq1$	1.146137	5.425444	1.712790	2.000091
Lag order					
L_D=1	**Max-Eigen**				
L_L=3,2,1	H_0: r=0	31.55320**	11.77147	4.384241	9.543640
	H_1: $r\leq1$	1.146137	5.425444	1.712790	2.000091

Table 6C.2 Cont'd

Country	Hypothesis	Deposit rates: >2yrs maturity	Lending rates: 1yr maturity,1-5 yrs maturity , over 5 years maturity		
		Deposit (>2yrs) 2003-2008	Lending (1yr) 2003-2008	Lending (1-5yrs) 2003-2008	Lending (>5yrs) 2003-2008
	Trace test				
Finland	H0: r=0	21.56066*	9.710432	16.59293	23.05404*
	H1: r≤1	1.087892	3.485141	1.241155	1.490396
Lag order					
L_D=1	**Max-Eigen**				
L_L=3,5,1	H0: r=0	20.47277**	6.225291	15.35177	21.56365*
	H1: r≤1	1.087892	3.485141	1.241155	1.490396
	Trace test				
	H0: r=0	14.19201	7.607981	22.08942*	17.77777
France	H1: r≤1	2.151628	2.492035	8.417378	5.479257
Lag order	**Max-Eigen**				
L_D=2	H0: r=0	12.04039	5.115947	13.67204	12.29852
L_L,4,2,1	H1: r≤1	2.151628	2.492035	8.417378	5.479257
	Trace test				
	H_0: r=0	17.85204	5.869147	21.59942*	10.85529
Greece	H_1: r≤1	3.855026	2.519563	1.135966	1.107601
Lag order	**Max-Eigen**				
L_D=6	H_0: r=0	13.99702	3.349584	20.46346**	9.747687
L_L=2,1,3	H_1: r≤1	3.855026	2.519563	1.135966	1.107601
	Trace test				
	H_0: r=0	6.351059	11.08642	24.07268*	7.202494
Ireland	H_1: r≤1	1.488693	3.871769	1.288254	0.930943
Lag order	**Max-Eigen**				
L_D=1	H_0: r=0	4.862366	7.214648	22.78442**	6.271551
L_L=2,1,4	H_1: r≤1	1.488693	3.871769	1.288254	0.930943
	Trace test				
	H_0: r=0	18.27116	18.36968	12.43231	19.25456
Italy	H_1: r≤1	1.286465	8.115209	1.398531	2.673583
Lag order	**Max-Eigen**				
L_D=1	H_0: r=0	16.98470*	10.25447	11.03378	6.58098*
L_L=3,2,1	H_1: r≤1	1.286465	8.115209	1.398531	2.673583

Table 6C.2 Cont'd

Country	Hypothesis	Deposit rates: >2yrs maturity	Lending rates: 1yr maturity, 1-5 yrs maturity, over 5 years maturity		
		Deposit (>2yrs) 2003-2008	Lending (1yr) 2003-2008	Lending (1-5yrs) 2003-2008	Lending (>5yrs) 2003-2008
	Trace test	-			
	H0: r=0		7.616831	16.88052	10.42116
Luxembourg	H1: r≤1		1.386435	1.067004	2.499878
Lag order	**Max-Eigen**				
L_L=3,1,3	H0: r=0		6.230396	15.81351	7.921286
	H1: r≤1		1.386435	1.067004	2.499878
	Trace test				
	H0: r=0	8.673385	12.97773	13.54570	13.17645
Netherlands	H1: r≤1	1.854240	2.473287	1.277251	0.959139
Lag order	**Max-Eigen**				
L_D=1	H0: r=0	6.819145	10.50445	12.26845	12.21731
L_L=2,2,1	H1: r≤1	1.854240	2.473287	.277251	0.959139
	Trace test				
	H_0: r=0	14.50949	6.859047	9.745832	9.397843
Portugal	H_1: r≤1	1.023858	2.252065	3.458535	2.536214
Lag order	**Max-Eigen**				
L_D=1	H_0: r=0	13.48563	4.606981	6.287297	6.861629
L_L=2,4,4	H_1: r≤1	1.023858	2.252065	3.458535	2.536214
	Trace test	-			
	H_0: r=0		13.18135	11.80413	13.77883
Sweden	H_1: r≤1		3.183458	5.154104	4.101380
Lag order	**Max-Eigen**				
L_L=3,3,3	H_0: r=0		9.997893	6.650024	9.677448
	H_1: r≤1		3.183458	5.154104	4.101380
	Trace test				
	H_0: r=0	18.36787	13.25115	6.789640	17.44668
UK	H_1: r≤1	5.422363	3.925606	1.652611	0.734725
Lag order	**Max-Eigen**				
L_D=4	H_0: r=0	12.94551	9.325548	5.137029	16.71196*
L_L=2,2,1	H_1: r≤1	5.422363	3.925606	1.652611	0.734725

Notes:
* Indicates rejection at the 5% level
** Indicates rejection at the 1% level

1. For the trace rank test :

At H_0 (r=0), the 5% critical value is 20.26 and the 1% critical value is 25.08
At H_0 ($r \leq 1$), the 5% critical value is 9.16 and the 1% critical value is 12.76

2. For the maximum eigenvalue rank test,

At H_0 (r=0), the 5% critical value is 15.89 and the 1% critical value is 20.16
At H_0 ($r \leq 1$), the 5% critical value is 9.16 and the 1% critical value is 12.76

3. The statistics are based on a Johansen VAR model with an intercept in the cointegrating equation and have been conducted in Eviews 6.

4. The lag orders of the VARs have been obtained by using the Akaike Information Criterion and run in Eviews 6;

5. The lag order selected for each VAR model is listed under L_D for the deposit rates data sets and under under L_L for the lending rates data sets, and they follow the same order as listed in the table.

Appendix 6D

Table 6D.1: Bai and Perron statistics for tests of multiple structural breaks in the non-financial corporations (NFC) short term lending spreads [1991-2002]

Country	Udmax[47]	WD max (5%)[48]	F(1/0)[49]	F(2/1)[50]	F(3/2)[51]	F(4/3)[52]	F(5/4)[53]
Austria	-	-	-	-	-	-	-
Belgium	122.602***	253.28**	30.6473***	11.675**	52.8512***	5.566	3.4897
Germany	287.4137***	494.1903**	39.5842***	28.5578***	30.6721***	11.7849*	30.671***
Denmark	326.9837***	717.524**	68.183***	11.6053**	92.2148***	27.6930***	0.0000
Spain	163.5642***	281.2386**	48.7612***	10.5582**	9.5079*	0.0000	0.0000
Finland	89.9578***	177.7642**	77.0197***	20.9000***	13.2930**	57.5220***	0.0000
France	53.9493***	79.5753**	16.6909***	3.0027	41.0653***	1.6622	0.0000
Greece	758.67***	1539.054**	130.732***	59.1515***	163.5205***	52.4620***	20.149***
Ireland	919.5831***	2017.91**	59.6554***	17.0575***	5.2565	5.2565	3.4727
Italy	1612.08***	3537.508**	50.3009***	29.5558***	4.1838	13.3070**	13.3070**
Netherlands	180.238***	314.99**	69.4233***	78.95***	14.4730***	8.9085	2.8916
Portugal	957.7572***	2101.68**	86.6979***	90.5352***	20.8202***	22.1718***	25.305***
Sweden	168.7987***	370.4073**	46.6268***	2.6981	7.4092	10.249*	7.4092
UK	89.2497***	152.6137**	4.4318	65.9395***	136.2371***	65.9395***	0.0000

Table 6D.2: Bai and Perron statistics for tests of multiple structural breaks in the NFC bank overdraft spreads [2003-2008]

Country	Udmax	WD max (5%)	F(1/0)	F(2/1)	F(3/2)
Austria	26.9230***	38.7583**	6.5013	26.1311***	7.6247
Belgium	32.5033***	32.5033**	32.5033***	8.3770	1.7469
Germany	26.4624***	29.7666***	26.4624***	11.8406**	12.2749**
Denmark	54.8510***	54.8510**	54.8510***	4.2195	4.2195
Spain	44.2293***	44.2293**	44.2293***	9.7852	2.3399
Finland	31.8957***	45.9169**	21.5204***	6.7920	18.2883***
France	23.6413***	31.8751**	23.6413***	7.5608	13.9695**
Greece	53.6968***	63.8114**	45.8798***	24.4761***	10.0368*
Ireland	124.291***	124.291**	124.291***	10.1909**	12.0102**
Italy	10.5434**	10.5434**	10.5434**	7.7923	0.6048
Netherlands	28.2918***	33.6210**	17.6346***	9.3320*	5.5270
Portugal	56.5846***	79.8834**	46.3275***	26.8652***	3.6354
Sweden	43.9671***	63.2950**	34.3194***	13.2662**	9.2327
UK	43.8601***	63.1408**	23.5800***	36.6532***	10.2128*

47 10, 5 and 1 per cent critical values are 7.46, 8.88 and 12.37, respectively.
48 Critical value is 9.91.
49 10, 5 and 1 per cent critical values are 7.04, 8.58 and 12.29, respectively.
50 10, 5 and 1 per cent critical values are 8.51, 10.13 and 13.89, respectively.
51 10, 5 and 1 per cent critical values are 9.41, 11.14 and 14.80, respectively.
52 10, 5 and 1 per cent critical values are 10.04, 11.83 and 15.28, respectively.
53 10, 5 and 1 per cent critical values are respectively 10.58, 12.25 and 15.76, respectively.
***significant at the 1% level; ** significant at the 5% level; *significant at the 10% level.
The Bai and Perron (1998) test statistics have been computed using Perron's GAUSS code (available on his home page:http://econ.bu.edu/perron/ and were run in OxEdit.

Table 6D.3: Bai and Perron statistics for tests of multiple structural breaks in the NFC lending spreads with 1 year maturity [2003-2008]

Country	UDmax[54]	WD max (5%) [55]	F(1/0)[56]	F(2/1)[57]	F(3/2)[58]
Austria	95.7780***	137.8818**	86.9401***	24.8705***	19.2542***
Belgium	110.5074***	131.3232**	11.9589**	62.2789***	2.4554
Germany	56.8645***	73.8009**	38.4154***	20.7160***	19.8540***
Denmark	28.9610***	28.9636**	28.9610***	17.7941***	11.3824**
Spain	160.8336***	231.5355**	66.2920***	7.6247	46.0231***
Finland	22.2978	32.0999**	2.9213	20.3833***	9.2281
France	54.4811***	66.5082**	49.2223***	25.1921***	9.6458*
Greece	29.2756***	34.7902**	1.2409	21.9867***	2.5934
Ireland	51.3814***	61.0599**	20.9469***	17.0044***	7.6473
Italy	146.9499***	174.6302**	52.5171***	23.8773***	13.5000**
Luxembourg	70.0370***	100.8251**	44.1580***	33.4312***	8.0950
Netherlands	22.1560***	30.2471**	11.0426**	7.2996	10.7792*
Portugal	65.3318***	81.2760**	27.0326***	122.206***	4.9235
Sweden	91.6973***	132.0072**	19.3271***	33.2195***	21.2770***
UK	44.8724***	64.5982**	25.5655***	39.3196**	11.0120*

Table 6D.4: Bai and Perron statistics for tests of multiple structural breaks in the NFC lending spreads with 1-5 years' maturity [2003-2008]

Country	UDmax	WD max (5%)	F(1/0)	F(2/1)	F(3/2)
Austria	16.3165***	16.3165**	16.3165***	5.0493	5.6458
Belgium	24.9730***	35.9510**	22.5965***	1.6230	2.7683
Germany	51.6740***	58.1818**	51.6740***	9.3468*	11.0998*
Denmark	84.2902***	100.1676**	42.9836***	44.3869***	6.7390
Spain	74.1583***	106.7581**	33.8353***	21.8290***	13.4163**
Finland	27.7451***	32.9713**	9.9152**	7.3118	8.1857
France	114.4944***	164.8259**	24.9308***	29.8855***	32.7762***
Greece	7.3514	8.7362	6.2056	15.3920***	15.3920***
Ireland	26.9946***	26.9946**	26.9946***	1.0728	7.2976
Italy	134.533***	134.533**	134.533***	3.1883	2.1388
Luxembourg	15.7963***	20.1644**	15.7963***	5.1204	16.5468***
Netherlands	21.9516***	31.6015**	9.0550**	12.4098**	2.5352
Portugal	85.9525***	123.7370**	30.8231***	59.4158***	40.0219***
Sweden	286.8658***	412.9713**	229.894***	21.3508***	3.4113
UK	18.0838***	26.0333**	8.3712*	21.3394***	3.2463

[54] 10, 5 and 1 per cent critical values are 7.46, 8.88 and 12.37, respectively.
[55] Critical value is 9.91.
[56] 10, 5 and 1 per cent critical values are 7.04, 8.58 and 12.29, respectively.
[57] 10, 5 and 1 per cent critical values are 8.51, 10.13 and 13.89, respectively.
[58] 10, 5 and 1 per cent critical values are 9.41, 11.14 and 14.80, respectively.
***significant at the 1% level; ** significant at the 5% level; *significant at the 10% level.

Table 6D.5: Bai and Perron statistics for tests of multiple structural breaks in the NFC lending spreads with over 5 years' maturity [2003-2008]

Country	UDmax[59]	WD max [60](5%)	F(1/0)[61]	F(2/1)[62]	F(3/2)[63]
Austria	17.8036***	23.0646**	17.8036***	5.6252	10.1042*
Belgium	70.9435***	84.7570**	46.6915***	31.2674***	1.3712
Germany	100.6731***	119.6365**	44.4494***	80.9820***	5.4551
Denmark	21.4726***	30.9120***	7.1389	13.6204**	8.2701
Spain	86.0702***	123.9064**	81.8218***	18.1515***	13.9158**
Finland	49.2838***	49.2838**	49.2838***	8.9322	1.0366
France	30.7431***	44.2578**	30.0102***	5.5844	14.1206**
Greece	12.1758**	14.0513**	12.1758**	18.4059***	10.6347*
Ireland	112.3448***	161.7312**	64.5595***	36.6083***	7.0810
Italy	109.20***	109.20**	109.202***	1.4552	3.9876
Luxembourg	24.9660***	35.9410**	4.3054	18.2133***	13.4503**
Netherlands	12.7564***	15.1593**	6.4206	18.6376***	2.4003
Portugal	86.1193***	123.9770**	43.0935***	32.2125***	7.9609
Sweden	105.6588***	125.5612**	77.0759***	67.7441**	2.1090
UK	26.0874***	31.0013**	23.3899***	6.2606	1.6916

Table 6D.6: Bai and Perron statistics for tests of multiple structural breaks in the NFC deposit spreads with 1 year maturity [2003-2008]

Country	UDmax	WD max (5%)	F(1/0)	F(2/1)	F(3/2)
Austria	43.4361***	61.7665**	10.8659**	66.3313***	14.2012**
Belgium	66.4631***	66.4631**	66.4631***	3.7642	9.0024
Germany	61.7908***	73.4301**	28.1022***	22.7294***	7.0329
Denmark	31.4627***	38.1629***	31.4627***	22.1426***	10.5635*
Spain	78.1417***	112.493***	57.4635***	24.8019**8	16.1185***
Finland	27.5590***	30.6068**	27.5590***	7.9753	8.2237
France	41.8445***	56.8452**	14.5204***	18.1778***	11.9353**
Greece	34.0621***	40.4782**	17.6262***	6.1359	4.9398
Ireland	43.7854***	63.0333**	9.1547**	32.6708***	33.9202***
Italy	34.3878***	49.5046**	11.8225**	12.5208**	12.6436**
Luxembourg	64.1929***	76.2847**	12.4770***	94.7887***	10.9104*
Netherlands	189.5850***	272.9261**	37.8692***	24.2434***	10.7348*
Portugal	179.3344***	258.1694**	35.4448***	15.3059***	24.7039***
Sweden	48.9846***	63.8639**	30.2268***	50.6432***	9.9148*
UK	150.920***	179.3481**	95.6958***	69.4719***	103.2197***

Note: Given that the number of observations is 72, the maximum number of breaks allowed in the Bai and Perron test, m, has been set at 3.

[59] 10, 5 and 1 per cent critical values are 7.46, 8.88 and 12.37, respectively.
[60] Critical value is 9.91
[61] 10, 5 and 1 per cent critical values are 7.04, 8.58 and 12.29, respectively.
[62] 10, 5 and 1 per cent critical values are 8.51, 10.13 and 13.89, respectively.
[63] 10, 5 and 1 per cent critical values are 9.41, 11.14 and 14.80, respectively
***significant at the 1% level; ** significant at the 5% level; *significant at the 10% level.

Table 6D.7: Bai and Perron statistics for tests of multiple structural breaks in the NFC deposit spreads with 1-2 years maturity [2003-2008]

Country	UDmax[64]	WD max [65](5%)	F(1/0)[66]	F(2/1)[67]	F(3/2)[68]
Austria	25.1871***	25.1871**	25.1871***	9.1087*	9.1087
Belgium	14.6910***	21.1491**	9.4679**	7.0296	10.8129*
Germany	14.1616***	16.8292**	12.4080***	2.0348	1.2529
Denmark	24.4445***	35.1903**	17.1719***	12.4807**	5.2413
Spain	37.6943***	37.6943**	37.6943***	14.1837***	3.4630
Finland	49.3369***	59.5665**	39.3229***	10.3694**	7.7899
France	7.4315	7.4315	7.4315*	1.0786	1.7397
Greece	49.1828***	70.8034**	19.9304***	12.5277**	21.2112***
Ireland	37.1760***	43.8036**	37.1760***	13.2817**	6.0793
Italy	33.3003***	47.9390**	27.3063***	9.8336*	4.0708
Luxembourg	35.7761***	51.5032**	1.4341	30.1201***	14.4670***
Netherlands	27.2410***	38.1453**	27.2410***	16.9191***	12.0350*
Portugal	34.5013***	49.6679**	34.0759***	19.0436***	5.7852
Sweden	123.1169***	146.3079**	49.7009***	21.1758***	35.4272***
UK	91.4615***	131.6678**	24.1617***	79.1385***	41.1421***

Table 6D.8: Bai and Perron statistics for tests of multiple structural breaks in the NFC deposit spreads with over 2 years' maturity [2003-2008]

Country	UDmax	WD max (5%)	F(1/0)	F(2/1)	F(3/2)
Austria	11.4496**	11.4496**	11.4496**	3.5300	3.5300
Belgium	301.0009***	433.3201**	58.3528***	38.8192***	22.5142***
Germany	28.8639***	41.5524**	23.5888***	3.5533	4.5849
Denmark	101.867***	101.867**	101.867***	16.4695***	14.4496***
Spain	7.3312	7.3312	7.3312*	1.8652	1.8652
Finland	37.8017***	54.4192**	8.2445*	5.3332	5.3332
France	20.3562***	20.3562**	20.3562***	3.6863	8.2617
Greece	12.5453***	17.2999**	10.0588**	2.6072	19.1485***
Ireland	100.4806***	144.6516**	19.8632***	18.2240***	16.7486***
Italy	71.0503***	84.4337**	66.0905***	18.5321***	5.6628
Netherlands	128.214***	147.6617**	128.214***	16.4837***	3.1286
Portugal	17.6941***	22.9248**	17.6941***	15.1564***	4.8318
UK	48.4590***	48.4590**	48.4590***	15.5843***	4.2434

[64] 10, 5 and 1 per cent critical values are 7.46, 8.88 and 12.37, respectively
[65] Critical value is 9.91
[66] 10, 5 and 1 per cent critical values are 7.04, 8.58 and 12.29, respectively
[67] 10, 5 and 1 per cent critical values are 8.51, 10.13 and 13.89, respectively
[68] 10, 5 and 1 per cent critical values are 9.41, 11.14 and 14.80, respectively
***significant at the 1% level; ** significant at the 5% level; *significant at the 10% level.

Appendix 6E

Table 6E.1: Structural break dates for the lending and deposit spreads for the Non Financial sector for the period 1991-2008

Country	ST Lending rates 1991-2002	Overdraft rates (2003-2008)	Lending rates (1 yr) 2003-2008	Lending rates (1-5yrs) 2003-2008	Lending rates (over 5 yrs) 2003-2008	Deposit rates (1 yr) 2003-2008	Deposit rates (1-2 yrs) 2003-2008	Deposit rates (over 2 yrs) 2003-2008
Austria	-	May 04, Sept 06	May 04, Feb 06, Sept 07	Oct 03	Apr 06	Dec 03, May 06, Feb 08	Feb 06	Sept 05
Belgium	Apr 95, Jun 97, Jun 99	Apr 05	Mar 05, Jun 06	Feb 05	May 05, Sept 06	Dec 03	May 04	Nov 03, Aug 06, Jun 07
Germany	Dec 92, Mar 95, Dec 96, Dec 98, Mar 01	Dec 03, May 05, Oct 07	Jun 04, Feb 06, Aug 07	Sept 06	Sept 04, Jun 07	Dec 03, Jan 06	Apr 06	Feb 06
Denmark	Oct 92, Nov 95, Oct 98, Aug 00	Jul 06	Oct 03, Sept 04, Feb 08	Jan 05, Nov 07	Sept 04, Feb 08	Dec 03, Feb 08	Oct 03, Oct 06	Jan 06, Jan 07, Jan 08
Spain	Aug 93, Sept 96	Feb 08	Nov 03, Apr 06, Jan 00	May 04, Nov 05, Oct 07	Aug 05, Oct 06, Feb 08	Dec 03, May 06, Dec 07	Jan 06, Dec 07	Jan 07
Finland	Nov 92, Oct 95, Sept 97, Sept 99	Nov 05, Sept 06, Nov 07	Mar 04, Feb 06	Aug 07	Feb 05	Oct 03	Nov 03, Oct 06	Jan 06
France	Sept 92, Mar 97, Sept 99	Jun 04, May 05, Aug 06	Apr 05, Jul 07	Jan 04, Feb 06, Oct 07	May 05, Apr 06, Jan 08	Dec 03, May 06, Feb 08	Sept 04	Feb 08
Greece	Apr 93, Mar 95, Jan 97, Dec 98, Sept 00	Feb 04, Aug 07	Nov 05, Jan 07	May 05, Jul 06, Nov 07	Aug 04, Jun 07	Dec 03	Mar 04, Oct 06, Jan 08	Jun 06, Apr 07, Feb 08
Ireland	Sept 92, Nov 96	Jun 04, May 05, Jul 06	Jan 04, Apr 06	Oct 06	Feb 06, Dec 06	Dec 03, Jan 06, Jan 08	Oct 03, Oct 06	Dec 04, Apr 06, Feb 07
Italy	Sept 92, Feb 95, Nov 96, Aug 98, Oct 00	Dec 03	Oct 03, Feb 05, Feb 08	Jan 06	Aug 05	Dec 03, Oct 05, Aug 06	Nov 06	Nov 05, Oct 06
Netherlands	Sept 94, Dec 96, Sept 98	Oct 07	Nov 03	Jun 04, Feb 06	Nov 04, Mar 06	Dec 03, Nov 05	Dec 03, Oct 04, Oct 06	Jan 04, Aug 07
Luxembourg	-	-	Feb 04, Nov 05	Oct 03, Feb 05, Mar 07	Oct 03, Nov 04, Apr 06	Nov 03, Aug 07	Nov 03, Oct 06, Feb 08	-
Portugal	Sept 92, Nov 94, Aug 96, May 98, Feb 00	Dec 05, Nov 06	Feb 06, Feb 08	Feb 05, Feb 06, Oct 07	Oct 05, Nov 06	Jan 04, Oct 06, Nov 07	Mar 04, Nov 06	Jun 06, May 07
Sweden	Jun 96	Jan 04, Nov 06	Jun 04, Apr 05, Jan 08	May 04, Jun 05	May 04, Apr 05	Apr 04, Nov 07	Apr 04, Apr 05, Aug 07	-
UK	Sept 92, Aug 94, Dec 96, Jun 00	Feb 04, Feb 08	Mar 04, Jan 08	Dec 03, Jan 08	Jan 04	Dec 03, Mar 06, Feb 08	Dec 03, Sept 06, Sept 07	May 04, Feb 08

Appendix 6F

Table 6F.1. Im, Pesaran and Shin (IPS) (2003) panel unit root test on spreads

Panel data	IPS test statistics
Deposit spreads 2003-2008 (1yr mat.) panel set	2.29758
2003-2008 (1yr mat.) demeaned panel set	-2.50922***
2003-2008 (1-2yrs mat.) panel set	1.22933
2003-2008 (1-2yrs mat.) demeaned panel set	-10.9180***
2003-2008 (>2yrs mat.) panel set	0.29836
2003-2008 (>2yrs mat.) demeaned panel set	-11.0280***
Lending spreads 1991-2002 (short-term)panel set	-0.06129
1991-2002 (short-term) demeaned panel set	-12.7372***
2003-2008 (1 yr mat.) panel set	0.55061
2003-2008 (1yr mat.) demeaned panel set	-8.51554***
2003-2008 overdrafts panel set	0.84753
2003-2008 demeaned overdrafts panel set	-9.77761***
2003-2008 (1-5 yrs mat.) panel set	0.10240
2003-2008 (1-5yrs mat.) demeaned panel set	-9.20789***
2003-2008 (>5 yrs mat.) panel set	0.21259
2003-2008 (>5yrs mat.) demeaned panel set	-12.2325***

Note:

1) The critical values (one-tailed normal distribution) at 1% and 5% and 10% are -2.3263, -1.6449 and -1.2816 respectively.

2) The lag for each individual series is selected based on the modified Akaike criterion.

3) The model used is one with individual intercept and no trend

3) The IPS unit root tests are conducted in Eviews 6.0

*** indicates significance at the 1% level, ** significant at 5%, * significant at 10%.

Appendix 6G

Table 6G.1 . CD tests on the deposit and lending spreads

Panel data	Cross section dependence (CD) test statistics
Deposit spreads	
2003-2008 (1yr mat.) panel set	2.55***
2003-2008 (1yr mat.) demeaned panel set	0.90
2003-2008 (1-2yrs mat.) panel set	13.15***
2003-2008 (1-2yrs mat.) demeaned panel set	10.15***
2003-2008 (>2yrs mat.) panel set	2.60***
2003-2008 (>2yrs mat.) demeaned panel set	1.87*
Lending spreads	
1991-2002 (short-term)panel set	-5.54***
1991-2002 (short-term) demeaned panel set	-2.11**
2003-2008 (1 yr mat.) panel set	-0.62
2003-2008 (1yr mat.) demeaned panel set	-1.26
2003-2008 overdrafts panel set	26.38***
2003-2008 demeaned overdrafts panel set	24.77***
2003-2008 (1-5 yrs mat.) panel set	3.10***
2003-2008 (1-5yrs mat.) demeaned panel set	3.11***
2003-2008 (>5 yrs mat.) panel set	21.81***
2003-2008 (>5yrs mat.) demeaned panel set	18.13***

Note:
1. The critical values for the CD tests [standard two-tailed normal distribution] for 10%, 5% and 1% significance levels are ±1.645, ±1.96 and ±2.575 respectively
2. The CD test statistics were run for each lag order (p) ranging from 1 to 12 and given similar results, the CD statistics reported in the table corresponds to p=6
3. The CD statistics were computed in OxEdit using the GAUSS code provided by Yamagata (2006)

*** indicates significance at the 1% level, ** significant at 5%, * significant at 10%.

Table 6G.2. Pesaran (2007) panel unit root test (CIPS) on spreads

Panel data	CIPS test statistics
Deposit spreads	
2003-2008 (1yr mat.) panel set	-0.089 (P=6)
2003-2008 (1yr mat.) demeaned panel set	-2.527*** (P=4)
2003-2008 (1-2yrs mat.) panel set	-1.227 (P=4)
2003-2008 (1-2yrs mat.) demeaned panel set	-3.181*** (P=5)
2003-2008 (>2yrs mat.) panel set	-1.430 (P=6)
2003-2008 (>2yrs mat.) demeaned panel set	-3.038*** (P=6)
Lending spreads	
1991-2002 (short-term)panel set	-3.968*** (P=4)
1991-2002 (short-term) demeaned panel set	-4.266*** (P=4)
2003-2008 (1 yr mat.) panel set	-1.147 (P=4)
2003-2008 (1yr mat.) demeaned panel set	-2.547*** (P=5)
2003-2008 overdrafts panel set	-1.313 (P=4)
2003-2008 demeaned overdrafts panel set	-2.991*** (P=3)
2003-2008 (1-5 yrs mat.) panel set	-1.725 (P=3)
2003-2008 (1-5yrs mat.) demeaned panel set	-3.521*** (P=6)
2003-2008 (>5 yrs mat.) panel set	-1.007 (P=5)
2003-2008 (>5yrs mat.) demeaned panel set	-2.954*** (P=5)

Note:

1. The CIPS critical values are listed in table 3b in Pesaran (2007).
   For N=15 and T=144, the critical values for 1%, 5% and 10% significance levels are around -2.425, -2.25 and –2.15 for case II [with intercept only].
   For N=15 and T=72, the critical values for 1%, 5% and 10% significance levels are approximately –2.435, -2.25 and –2.145 for case II [with intercept only].
   *** denotes significance at 1%, ** at 5%, * at 10%.
2. The lag order selected for each panel data set is indicated within brackets.
3. The model used includes an intercept.
4. The CIPS statistics were computed in OxEdit using the code written by Yamagata (2006).

Appendix 6H

Table 6H.1. Phillips and Sul (2007) Log *t* test

$$Log\left(\frac{H_1}{H_t}\right) - 2\log L(t) = \hat{a} + \hat{b}\log t + \hat{u}_t$$

Data series	$\hat{b}$	*t*-statistics
Deposit rates		
2003-2008 (1yr mat.) panel set	2.271	9.128
2003-2008 (1-2yrs mat.) panel set	3.090	11.181
2003-2008 (>2yrs mat.) panel set	0.480	8.030
Lending rates		
1995-2002 (short-term)panel set	1.060	12.099
2003-2008 (1 yr mat.) panel set	0.716	6.754
2003-2008 overdrafts panel set	-0.193	-7.542*
2003-2008 (1-5 yrs mat.) panel set	-0.179	-3.593*
2003-2008 (>5 yrs mat.) panel set	0.051	0.820

Note
-The Phillips and Sul (2007) log t-test were run in OxEdit using the Gauss code programmed by Sul (2007)
* Indicates rejection of the null hypothesis of convergence at the 5% significance level.

Table:6H.2. Phillips and Sul (2007) Club Convergence Test

$$Log\left(\frac{H_1}{H_t}\right) - 2\log L(t) = \hat{a} + \hat{b}\log t + \hat{u}_t$$

Data series	$\hat{b}$	t-statistics
2003-2008 (1yr mat.) deposit panel data set		
Club 1: Austria, Belgium, Germany, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal, Sweden, Luxembourg, UK	2.036	11.994
2003-2008 (1-2yrs mat.) deposit panel data set		
Club 1: Austria, Belgium, Germany, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal, Sweden, Luxembourg, UK	2.789	12.183
2003-2008 (>2yrs mat.) deposit panel data set		
Club 1: Austria, Belgium, Germany, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal, UK	0.348	7.649
1995-2002 (short-term) lending panel data set		
Club 1: Germany, Greece, Ireland	3.725	15.954
Club 2: Austria, Belgium, Spain, Finland, France, Italy, Netherlands, Portugal, Sweden, Denmark, UK	0.756	34.042
2003-2008 (1 yr mat.) lending panel data set		
Club 1: Austria, Belgium, Germany, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal, Sweden, Luxembourg, UK	0.827	11.719

Table:6H.2 cont'd. Phillips and Sul (2007) Club Convergence Test

$$Log\left(\frac{H_1}{H_t}\right) - 2\log L(t) = \hat{a} + \hat{b}\log t + \hat{u}_t$$

2003-2008 overdrafts lending panel data set		
Club 1: Austria, Belgium, Germany, Denmark, Finland, France, Greece, Italy, Netherlands, Portugal, Sweden, UK	1.128	15.306
Divergent countries: Ireland, Spain	-0.446	-30.031*
2003-2008 (1-5 yrs mat.) lending panel data set		
Club 1: Greece, Ireland, Spain, Portugal, UK	1.443	11.351
Club 2: Austria, Belgium, Germany, Denmark, Finland, France, Netherlands, Sweden	0.234	2.082
Divergent countries: Italy, Luxembourg	-0.947	-528.882*
2003-2008 (>5 yrs mat.) lending panel data set		
Club 1: Austria, Belgium, Germany, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal, Sweden, Luxembourg, UK	0.028	0.910

Note:
-The Phillips and Sul (2007) club clustering log t-test were run in OxEdit using the Gauss code programmed by Sul (2007)
* Indicates rejection of the null hypothesis of convergence at the 5% significance level.

Chapter 7

Assessing convergence in the European Union retail banking sector through banks' cost efficiency and profitability

7.1 Introduction

In chapters five and six, the integration process in the European Union retail banking sector is investigated by analysing the retail deposit and lending rates for 15 EU Member States. In this chapter, the aim is to assess the convergence process in the European Union banking sector by investigating the cost efficiency and profitability ratios for the retail banks of the 15 EU countries. The hypothesis being that, if integration is indeed underway in the banking sector, then it should translate into convergence in i) the cost efficiency and ii) the profitability of the banks.

Consequently, the main contributions of this chapter are as follows. Firstly, an analysis of the retail banking integration process is presented by applying robust panel data methodologies, namely the Phillips and Sul (2007) convergence tests, to both efficiency and profitability ratios of the EU retail banks. Efficiency and profitability variables are specifically chosen because they provide two other critical windows through which the impact of competitive pressures emanating from the efforts by the Commission to establish a single market in banking can be analysed. Indeed, if a homogenous banking market and competition do lead to further integration, then the impact should be felt on the prices of banking products (which are investigated in chapters 5 and 6) and on the cost structures of banks (efficiency) and on bank' overall performance (profitability).

Hence a higher level of competition should decrease banks' prices, encourage them to lower their costs and affect their profits. Moreover, in chapters 5 and 6, the convergence tests are conducted on aggregated pricing data on deposit and lending rates and in this chapter, the analysis is taken a step further by focusing on micro-data. The efficiency and profitability data are taken from the income statements and balance sheets compiled by the OECD on the retail banks from individual EU countries. A micro-data analysis should therefore complement the analysis conducted in the previous two chapters.

Secondly, the Phillips and Sul convergence methods have not been previously employed in this area and there are also very few studies that have focused on the convergence of efficiency or profitability of EU banks. Thirdly, the analysis is conducted over the period 1990 to 2008, which covers the time span investigated in chapters 5 and 6; hence enabling direct comparisons to be made. Fourthly, a visual inspection of the transition paths for each individual country provides additional information on the speed of the convergence process over time while the clustering test identifies any sub-clusters of convergence, if present. Fifthly, the results obtained under the Phillips and Sul methodologies should shed more light on the relationship between convergence in banks' efficiency and convergence in their profitability.

The chapter is organised as follows: section 7.2 discusses competition and efficiency in the EU banking sector while section 7.3 reviews the profitability trends and existing literature in the area; section 7.4 discusses the data used in this chapter; section 7.5 presents the empirical results obtained under the Phillips and Sul methods for the efficiency ratios and efficiency scores; section 7.6 presents the results for the profitability ratios; section 7.7 compares the results obtained for the two banking ratios; and section 7.8 concludes.

7.2 Competition and efficiency in the European retail banking sector

It is arguable that an integrated retail banking market should promote competition and thus efficiency in this sector. The measurement of efficiency and competition in the European banking sector has widely been investigated (see Molyneux et al (1997), Tomova (2005), Goddard et al (2007), Mamatzakis and Koutsomanoli (2009), amongst others). In general, it is agreed that greater competition, faster technologies and financial innovations have driven banks to minimise costs and improve their efficiencies. This view is also shared by Hasan et al (2009) who conduct an analysis in the European retail payments market to test whether competition and the development of new technologies in retail payments is indeed a precursor to efficiency. Their study looks at accounting and efficiency ratios for 27 European banking markets over the period 2000 to 2007 and they conclude that there is indeed a positive relationship between developed retail payment services and the performance of retail banks. Fiordelisi et al (2010) also echo the view that deregulation and technological development have promoted competition in the financial services industry and as a result, stronger emphasis is being laid on the importance of improving efficiency in the banking sector. Hence, given the link between competition and the growing focus on improving efficiency, it can therefore be hypothesised that within an integrated or integrating retail banking sector, these forces should translate into convergence in the cost efficiency of retail banks.

As mentioned earlier, several studies have been conducted on European banking efficiency; more specifically on its measurement and the analysis of cross-country differences. A review of the literature reveals the existence of only two studies [Casu and Molyneux (2003); and Weill (2009)] that have specifically attempted to investigate the convergence of efficiency measures within the European retail banking sector. However, it must be noted that between these two studies; it is only the one by Weill (2009) that actually applies a specific convergence technique to estimated efficiency measures.

In their study, Casu and Molyneux (2003) employ the non-parametric Data Envelopment Analysis (DEA) approach to investigate whether productive efficiency in European banking for the period 1993 and 1997 has converged to a common European frontier. The DEA methodology is applied to 750 banks from France, Germany, Italy, Spain, and the UK. In defining the inputs and outputs of banks, Casu and Monyneux (2003) follow the intermediation approach whereby deposits are defined as inputs. The authors define total loans and other assets as the total outputs in their model. Based on their results for the DEA relative to the European common frontier[1], Casu and Molyneux (2003) report that over the period 1993 to 1997, an improvement in the average efficiency scores can be observed for all the banks in all the countries, except for Italy which shows a slight deceleration. However, the results mostly show that the efficiency gap between the countries has widened over this period and thus conclude that there is little evidence of convergence.

[1] Calculated by pooling the data set for all the banks in the 5 countries

Weill (2009) argues that the main objective behind banking integration is the convergence in the prices of similar instruments. For this to happen, convergence in cost efficiency of banks is a prerequisite as otherwise the convergence process can be thwarted by large differences in banking costs. Hence, cost efficiency convergence provides another framework for the analysis of retail banking integration. Weill (2009) applies the beta and sigma convergence test to mean cost efficiency scores that were estimated for banks from ten[2] European countries for the period 1994 to 2005.

Cost efficiency is measured through the use of a stochastic frontier approach whereby a system of equations consisting of a Fourrier-flexible cost function is derived. The model used is as follows:

$$S_n = \frac{\partial \ln\left(\frac{TC}{W_3}\right)}{\partial lnW_n} = \beta_n + \sum_k \beta_{nk} \ln\left(\frac{W_k}{W_3}\right) + \sum_m \gamma_{nm} lny_m + \eta_n \qquad (1)$$

Where TC = total costs; y_m is the *m*th bank output (m=1,2); w_n is the *n*th input price (n=1,2); w_3 is the price of borrowed funds; S_n is the input cost share which is equal to the expenses for the input n divided by total costs (n=1,2); and η_n is the error term. The data used to estimate the mean efficiency scores are sourced from a sample of commercial, savings and cooperative banks from the ten EU countries, giving a total of over 14,000 observations. For the definition of inputs and outputs, Weill (2009) takes the intermediation approach whereby it is assumed that banks collect deposits to transform them into loans.

[2] Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, Portugal, Spain, UK

Thereafter Weill (2009) applies the β-convergence test through the following equation:

$$lnEFF_{i,t} - lnEFF_{i,t-1} = \alpha + \beta lnEFF_{i,t-1} + \sum_{i=1}^{9} D_i + \varepsilon_{i,t} \quad (2)$$

Where $EFF_{i,t}$ is the mean cost efficiency score of banks for country i in year t, $EFF_{i,t-1}$ is the mean cost efficiency score in year t-1; D_i are the country dummies; ε_i is the error terms and α and β are the parameters to be estimated.

As for σ-convergence, Weill (2009) estimates it through the equation below:

$$\Delta W_{i,t} = \propto + \beta W_{i,t-1} + \sum_{i=1}^{9} D_i + \varepsilon_{i,t}. \quad (3)$$

Where $W_{i,t}$ = $ln\,EFF_{i,t} - MEFF_t$ ($MEFF_t$ is the mean of $ln\,EFF_{i,t}$ for each period; D_i are the country dummies; ε_i is the error terms and α and β are the parameters to be estimated.

The results obtained by Weill (2009) from the β-test and σ-test find evidence in support of convergence in cost efficiency in the EU banking. These findings are based on convergence tests applied to cost efficiency scores obtained under the stochastic frontier methodology and through the application of the intermediate approach. It should be noted that these findings are also subject to several robustness checks including two other frontier techniques namely, a time-varying WITHIN model and a distribution free approach (DFA) model as well as the use of the production approach instead of the intermediation approach in the event that the specifications of inputs and outputs have biased the results. In all three instances, Weill (2009) obtains the same conclusions on convergence. In addition, these findings, in turn, back the hypothesis of banking integration in the EU banking sector. In an attempt to test whether the increase in cost efficiency is the result of an increase in competition within the EU banking sector, Weill (2009) runs a Rosse-Panzar model to measure the level of competition in the EU banking. He concludes that a monopolistic market structure prevails in the EU banking markets and that banking competition did not actually increase during the period investigated. However, the author does argue that the possible entry of foreign banks may have acted as a trigger for banks to improve their efficiency. Weill (2009) also argues that the introduction of technical progress, in the form of lower technology costs, may have had a role to play in improving the cost efficiency for banks, especially the least efficient ones.

7.3 Profitability in the EU banking sector

Another framework through which retail banking integration can be assessed is by testing for convergence in the profitability of EU retail banks. So far, there are only two known recent studies [Gropp and Kashyap (2009); and Goddard et al (2009)] that test for convergence in the profitability of European retail banking profitability. However, it must be noted that it is only the study by Gropp and Kashyap that specifically applies a test of convergence to EU profit data to assess integration in EU banking. The one by Goddard et al, on the other hand, study the convergence of profitability towards long run equilibrium at individual country-level within a sample of eight EU countries and inferences are subsequently drawn thereupon.

Gropp and Kashyap (2009) argue that banking integration should lead to bank entries and takeovers which would spur a convergence in profitability. The reasoning the authors follow is that convergence in profitability as measured by the return on assets should be present if a) the structure of the retail banking sector consists of a contestable products market and b) operating practices and strategies are conducted efficiently. Building on this framework, Gropp and Kashyap (2009) propose a new test of integration which is based on a partial adjustment equation. The study tests for convergence in the return on assets (ROA) of banks from France, Germany, Italy, Spain and the UK for the period 1994 to 2006. The empirical testing of convergence is conducted through the following model which is estimated for all banks:

$$\Delta ROA_{it} = \alpha + \lambda \Delta ROA^{*}_{t} - \beta \Delta ROA_{it-1} + W_{it} \quad (4)$$

Where ROA* represents long run equilibrium profitability.

Gropp and Kashyap defines an integrated EU banking sector as one in which all EU banks converge to the same equilibrium value, i.e. ROA*, which is represented by the overall mean profitability rate across the sample. The above equation (4) is estimated for different types of banks; namely listed banks, unlisted commercial banks and savings and cooperatives banks.

Based on the estimates of λ, Gropp and Kashyap find evidence of convergence in profit for listed European banks. However, this result is not replicated for unlisted commercial banks and for savings and cooperatives banks. The authors conclude that limited integration is present in the case of European retail banks given the relatively small number of publicly traded banks compared to the number of unlisted banks.

Goddard et al (2009) conduct an empirical analysis of the determinants of profitability for banks located in eight EU countries (Belgium, Denmark, France, Germany, Italy, Netherlands, Spain and UK) for the period 1992 and 2007. The study formulates a dynamic profit equation with a partial adjustment mechanism. Thus, the model specification also allows for inferences to be made on the extent to which profits converge towards their long-run equilibrium. The motivation behind the model specification is that abnormal profits are a result either of market power or of higher efficiency or product innovation. Over time, it is expected that entry of banks will boost competition and eliminate abnormal profit. Consequently, the following autoregressive model is estimated:

$$\pi_{i,t} = (1 - \lambda_1)\tilde{\pi}_{i,t} + \lambda_1 \pi_{i,t-1} + v_{i,t} \qquad (5)$$

Goddard et al (2009) then express $\pi_{i,t}$, the profitability ratio (ROA) as a function of vectors $x_{i,t}$ and m_t (which consist of market share, capital ratio, cost-income ratio Herfindahl-Hirshman concentration index, amongst others) as follows:

$$\tilde{\pi}_{i,t} = \left(\alpha_i + \beta_1 x_{i,t} + \beta_2 m_t\right)/(1 - \lambda_1) \qquad (6)$$

Goddard et al (2009) estimate the above equation for commercial, savings and cooperative banks for eight EU member countries (Belgium, Denmark, France, Germany, Italy, Netherlands, Spain and UK) for the period 1992 to 2007. The model is estimated for each of the eight samples individually. The authors conclude that there is significant persistence of profitability ratio in each year for all the banks of the 8 countries in the sample but that it has fallen over the years. This is interpreted as an increase in the intensity of competition and the speed of profit convergence towards their equilibrium at country-level due to the introduction of the euro and the Financial Services Action Plan.

7.4 Data

In order to assess the convergence in profitability and cost efficiency of EU banks' in this chapter, the Phillips and Sul (2007) methodologies, as discussed in Section 4.6 in Chapter 4, is applied to the following 3 panel datasets:

i) Cost-income ratio[3] of retail banks (commercial, savings and cooperative banks) for the 15 EU countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Luxembourg, Netherlands, Portugal, Spain, Sweden, UK) for the period 1990-2008. The cost-income ratio is used as a proxy for cost efficiency in the EU banks. This approach is commonly adopted in the literature (see Focarelli and Pozzolo (2001), Goddard et al (2009)) and the interpretation of this ratio is fairly straight-forward. In brief, heightened levels of competition should encourage banks to lower

[3] Cost to income ratio = total operating cost/total income

their costs and thus their cost-income ratios would also decrease as a result. The cost-income ratios have been calculated from the income and balance sheet statements of the retail banks from the 15 EU countries. These income and balance sheet statements have been aggregated and compiled at country-level by the OECD and made available from the OECD database[4].

ii) Cost efficiency scores computed by Weill (2009) for 10 EU countries (Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, Portugal, Spain, UK) for the period 1994 to 2005. Thus, the Phillips and Sul (2007) convergence methodologies are also applied to the means of cost efficiency scores which are now widely used in the literature as a measure of efficiency. The efficiency scores used have been estimated by Weill (2009) using an intermediation approach for the specification of inputs and outputs of banks and following a stochastic frontier approach (see table 2 page 824 in Weill). The reason why these specific efficiency scores are used is that these findings have been subject to several robustness checks by Weill and proven to be reliable. In addition, cost efficiency estimated under the stochastic frontier approach is considered to be robust and informative and increasingly popular in the banking literature (see Molyneux et al, 2010, amongst others). Therefore, the application of convergence tests to cost efficiency scores together with similar tests applied to cost-income ratios provide a deeper and multi-faceted analysis to the convergence process in EU retail banks' efficiency. Ideally, this chapter should include the author's own calculation of efficiency scores for all the 15 EU countries for the period 1990 to 2008. However, this is a major project on its own and beyond the scope of this thesis. It is though a project that will certainly be tackled in the future.

[4] http://www.sourceoecd.org/database/OECDStat

iii) Return on assets[5] (ROA) of retail banks (commercial, savings and cooperative banks) for the 15 EU countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Luxembourg, Netherlands, Portugal, Spain, Sweden, UK) for the period 1990-2008. The ROA for the retail banks have been calculated using data from the income and balance sheet statements of the retail banks from each EU-15 country. These income and balance sheet statements have been compiled and aggregated by the OECD at country-level and made available on its database[6]. This micro-data convergence analysis on banks' profitability is the third framework (other than pricing of banks' products and cost efficiency) under which the retail banking integration process can be assessed.

Additional information on the source of the profitability and efficiency data for the retail banks from each individual EU country is provided in Appendix 7A.

7.5 Phillips and Sul (2007) panel tests results for efficiency data

7.5.1 Phillips and Sul (2007) log *t*-test

As per the recommendation of Phillips and Sul (2007), the convergence analysis is conducted on filtered data series whereby the cycle component of each series is

[5] Return on assets = income before tax/average assets. This definition is also used by Goddard et al (2009).
[6] http://www.sourceoecd.org/database/OECDStat

removed by applying the Hodrick-Prescott (1997) filter[7]. The log-t statistics obtained for the cost-income ratio and the mean efficiency scores are tabulated in Appendix 7B, Table 7B.1. Based on these statistics, the hypothesis of convergence in efficiency is rejected at the 5% significance level in both panel data sets. For the cost-income ratio panel (1990-2008), the t-statistic is -5.402 while for the cost efficiency scores (1994-2005), the t-statistic is -2.224; both below the critical value of -1.65. However, it should be noted that if tested at 1% significance level (critical value = -2.33), then the t-statistic for the cost efficiency scores cannot be rejected. The value of $\hat{b}$ whose value is linked to the rate of convergence is actually negative in both instances but higher in the case of the cost-income ratio panel ($\hat{b}$=-5.195) compared to the efficiency score panel dataset ($\hat{b}$=-0.189).

The rejection of the null of convergence for EU retail banks' efficiency based on the convergence results for the cost-income ratios is in line with the findings of Casu and Molyneux (2003) who find little evidence of convergence in bank efficiency. As for the group convergence results for the cost efficiency scores, the interesting observation here is that the evidence of convergence at 1% significance level only is in line with the results obtained by Weill (2009) who find evidence of EU banking efficiency at 1% significance level too. So based on the Phillips and Sul (2007) log t-test (at 1% level), it can be argued that convergence in retail banks' cost efficiency scores for the period 1994 to 2005 is present in the whole group of 10 countries. The Phillips and Sul methodology is better suited for this analysis as the time varying component of this test not only reveals the speed at which retail integration is taking place if present (which is also indicated by the beta and sigma convergence tests) but also highlights the different

[7] λ is set at 100 as per the recommendation in the literature for yearly data.

extent and speed of the integration level in the group of countries through the process of club formation. In particular, this second feature of the Phillips and Sul methodology makes it superior to the beta and sigma convergence test as the Phillips and Sul convergence test allows for both common and individual heterogeneity (Phillips and Sul, 2007). These limitations have also been previously discussed by Quah (1996) who argues that beta convergence is uninformative on the behaviour of the dispersion of the entire cross-section. He further argues that sigma convergence does not factor in the convergent or divergent behaviour of individual countries in the sample but is only concerned with how the whole cross-section behaves.

The Phillips and Sul log t test have yielded some interesting results. The next section discusses the Phillips and Sul club convergence test results which shed more light on the convergence process in European retail banking efficiency.

7.5.2 Phillips and Sul (2007) club clustering test for cost income ratios

The club clustering convergence test results for the cost-income ratio panel (1990-2008) reveal some interesting findings as the presence of four distinct clusters are identified (see Table 7B.2 in Appendix 7B). The first cluster groups Belgium, Netherlands, and UK while the second cluster comprises France and Germany. The third cluster consists of Austria, Denmark, Greece, Italy, Portugal and Sweden while the fourth club groups Finland, Luxembourg and Spain. So, even though as a group, the cost-income ratios for the retail banks' in the 14 EU countries[8] are not converging, club convergence within the panel is clearly evident. Furthermore, looking at the speed of convergence in the sub-clusters, it can be observed that the fourth cluster (Finland, Luxembourg and Spain) shows by far the fastest rate of convergence ($\hat{b}$=2.433) followed by the third cluster ($\hat{b}$ =0.489). As for the first and second clusters, the rate of convergence is actually negative, ($\hat{b}$ =-2.433, -2.081). This additional information probably explains why the log-*t* test rejects the null of convergence for the whole group. It would seem that Belgium, Netherlands, France, Germany and the UK (most of the biggest economies in the EU) clearly have similar convergent behaviour and also differ from the rest of the group.

This point is further emphasised by the clustering pattern of the countries. For instance, the first club of countries, Belgium, Netherlands and UK, share some similarities. Firstly, the retail banks in these countries have some of the highest bank concentration ratios in the EU. The report by the European Commission (2007b) look at the concentration ratios for the three (CR3) and five (CR5) largest retail banks for EU retail banks for the period 2004 using various indicators such as total retail income and market share and find that in general, there is a large diversity among the largest players in the EU member countries, except for Belgium and Netherlands where the same banks do appear again in the first top 3 or 5 banks. These two countries also have the highest CR3 ratio among the 15EU countries, with above 80% for the period 2004. These results are also replicated in Goddard et al (2009) who estimate the Herfindahl-Hirshman concentration index for the EU banks for the period 1992 to 2007 for Belgium (1723), Netherlands (2670) and UK (1162) to be significantly above those of

[8] Data for Ireland has been excluded in this panel in order to run the test on a balanced panel.

the other EU countries, except for Denmark. Hence, a link between market concentration and cost efficiency is possible and that could explain the similarity in the convergence patterns for these three countries. Another striking similarity between Belgium and the Netherlands, apart from close regional cooperation, is the high market share of banks' assets as a proportion of total banking sector assets. As calculated by Goddard et al (2009) for the period 1992-2007, the market share for Belgium and the Netherlands are by far the highest. This again points to a link between market share and convergence in efficiency. In fact, Schaeck and Cihak (2008) do find an empirical link between market share and cost efficiency in their study and suggest that banks with a relatively large size may have access to better technologies and hence more likely to increase their efficiency compared to smaller banks. Additionally, in the Netherlands and the UK, the banking sector is dominated by large oligopolistic national players and this reinforces the point made above on the relationship between market structure and cost efficiency.

As for the second cluster of convergent efficiency ratios group, namely; Germany and France, these two countries also share certain similar retail banking characteristics. For instance, the banking structure in both countries consists of a large number of retail banks and branches, especially those of savings banks (OECD database, European Commission 2007b). Furthermore, in an empirical study on market structures within the EU in the 1990s, De Bandt and Davis (2000) highlight the similarity of the banking structure in Germany and France, whereby it is observed that large banks tend to operate within monopolistic competition while small banks act as monopolists. In particular, the authors single out France and Germany as exhibiting lower levels of bank competition, especially concerning small institutions. Along similar lines, Casu and

Girardone (2006) estimate the CR5 index for France and Germany at around 60% and 55% in 1997 and 66% and 61% in 2003, respectively. These indices are fairly different and below the ratios for the other EU countries which tend to range around 80%, except for Italy, Spain and Luxembourg. These findings lend weight to the above argument that France and Germany have very similar market structures and levels of competition in retail banking.

The third cluster reveals that six out of the 14 EU countries in the sample, namely Austria, Denmark, Greece, Italy, Portugal and Sweden show convergence in their cost income ratios. The fact that almost half of the countries in the sample belong to one sub-cluster provides significant support in favour of convergence in cost efficiency and hence EU retail banking integration. The triggers are likely to be the competition pressures brought upon by various regulatory and institutional changes stemming from the Single Market and the Financial Services Action Plan. As reported in a recent study by Schaeck and Cihak (2008), who apply a Granger causality test on competition and efficiency on a European dataset of banks over the period 1995- 2005, a positive link between competition and profit efficiency (which incorporates cost efficiency) is identified. The study also finds that efficiency can in turn Granger-cause competition. Overall, these findings lend weight to the hypothesis formulated in section 7.1 that that competition and efficiency in the European retail banking sector do promote integration.

The fourth cluster in cost-income convergence groups Finland, Luxembourg and Spain. The specific grouping of these countries is quite revealing as based on the computed cost income ratios, these three countries, alongside with Ireland[9], have, on average, the lowest cost ratios among the 15 EU countries for the period 1990-2008. The grouping thus suggests that on top of having the lowest cost income ratios (highest efficiency ratios), the cost –income ratios for retail banks' in Finland, Luxembourg and Spain are also converging.

7.5.3 Phillips and Sul (2007) club clustering test for cost efficiency scores

The club clustering convergence test results for the means of cost efficiency scores panel (1994-2005) reveals the presence of two sub-clubs of convergence (see Table 7B.3 in Appendix 7B). The first club groups Luxembourg and UK while the second club comprises Austria, Belgium, Denmark, France, Germany, Italy, Portugal and Spain. It is not surprising that the clustering of the clubs is much more pronounced in the case of the panel of efficiency scores compared to the panel for cost-income ratios given the log-t test results discussed in Section 7.5.1. However, based on the magnitude of $\hat{b}$, it is observed that the second club which groups most of the countries show slow rate of convergence ($\hat{b}$=0.038) while the first club actually shows negative rate of convergence ($\hat{b}$.=-2.063). Of notable interest is that similar to the club convergence results on cost-income ratios, the UK is once more in the club of countries that should negative convergence.

The club clustering test results suggest that based on cost efficiency scores, convergence is well underway in the European retail banking sector given that all of the countries in

[9] The data for Ireland starts in 1995 and for this reason, Ireland has been excluded in the convergence club test in order to create a balanced panel.

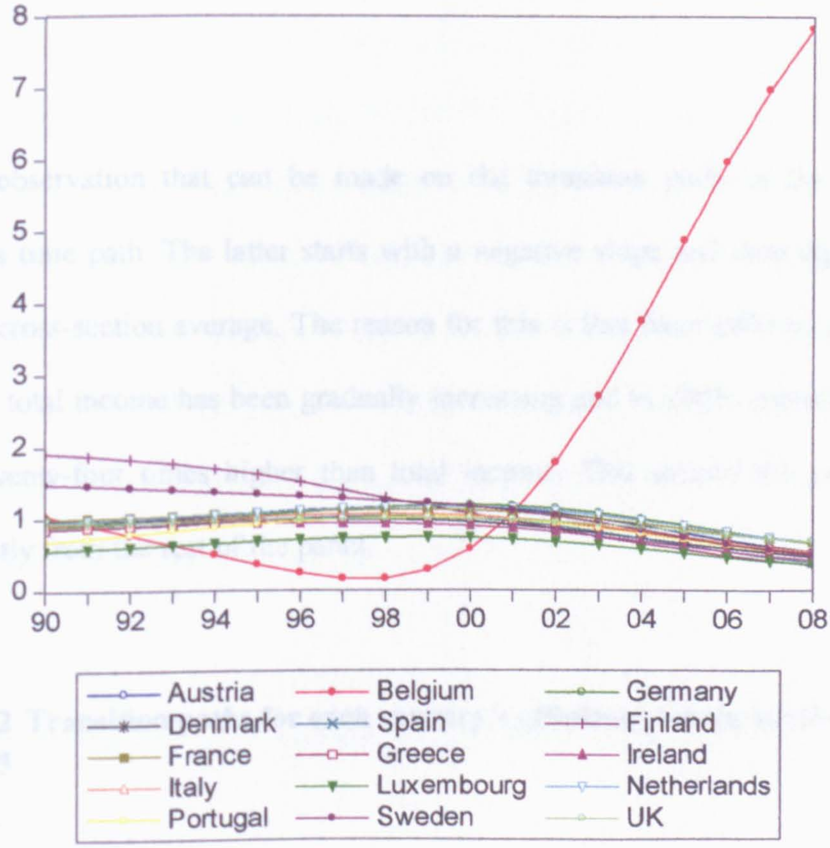
the sample, except for two, belong to the same club. As for Luxembourg and the UK, the similarity in their convergence patterns in cost efficiency could be explained by the existence of common regulation and low barriers to competition. A report by the OECD (2006) constructs a composite index of regulatory barriers to banking competition based on four sets of criteria, namely domestic entry (licensing requirements); foreign entry (screening and approval); activity (securities/insurance); and government ownership and rates Luxembourg and the UK, alongside Finland[10], as having the lowest barriers to competition. Both Luxembourg and the UK have a score of 0.28 (the scale of the indicator is from 0-1, from least to most restrictive).

7.5.4 Cost efficiency transition paths

The figure 7.1 below provides a visual depiction of the path of the transition coefficients for the cost income ratios for the banks of the 15 EU countries over the period 1990-2008. Although the null of convergence for the whole panel of countries has been rejected under the log *t*-test, the club clustering tests and the transition paths for the countries do provide evidence of convergence within a somewhat heterogeneous panel.

[10] Finland is not part of the 10 EU countries tested by Weill (2009).

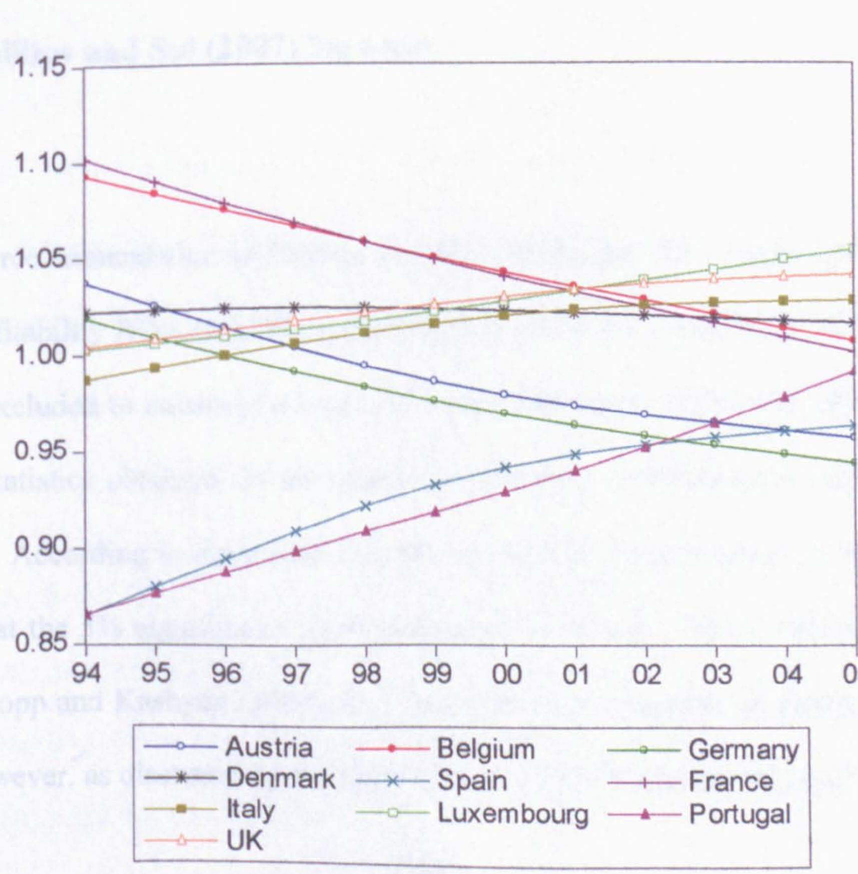
Figure 7.1 Transition paths for each country's cost income ratios for the period 1990-2008



As illustrated above, the behaviour of the transition paths for the cost-income ratios for all the countries shows a tendency to converge towards the cross-section average from 1998 onwards. The year 1998 actually corresponds to two major events in the EU banking sector which could have spurred on the integration process. Firstly, in May 1998, the Directive on settlement finality in payment and securities settlement systems was adopted. This Directive aims at facilitating the existing cross-border payment and securities settlement systems and make them more cost effective and efficient by specifically covering collateral security. Secondly, in late 1998, the European Commission presented its Financial Services Action Plan (FSAP) which aims at improving the single market in financial services. With regards to the retail banking market, the proposals identified six main areas for progress, namely information and transparency, redress procedures, customer protection rules, electronic commerce, insurance intermediaries, and cross-border retail payments. So, overall, it looks like these key initiatives have had an impact on the convergence process of cost efficiency.

Another observation that can be made on the transition paths is the behaviour of Belgium's time path. The latter starts with a negative slope and then digresses widely from the cross-section average. The reason for this is that from 2003 to 2008, the ratio of cost to total income has been gradually increasing and in 2008, operating costs were almost twenty-four times higher than total income. This caused the path to diverge significantly from the rest of the panel.

Figure 7.2 Transition paths for each country's efficiency scores for the period 1994-2005



The visual depiction of the behaviour of the transition coefficients for the means of cost efficiency scores for each individual country is quite striking and seems to highlight a catching-up process in cost efficiency for all the countries in the panel. At the start of the period, the gap in the efficiency scores between the 10 EU countries seems relatively large. For example, it can be observed that the path for Portugal and Spain start significantly below the cross-section average while those of Belgium and France start well above the panel average. However, towards the middle of the period, a clear reduction in the gap between the countries is visible and the trend continues until the end of the period, 2005. So overall, the time paths for the individual countries suggest that heterogeneity is present with respect to retail banks' cost efficiency scores but that it has definitely decreased over the period investigated.

7.6 Phillips and Sul (2007) panel tests results for profitability

7.6.1 Phillips and Sul (2007) log *t*-test

As per the recommendation of Phillips and Sul (2007), the log *t*-test is conducted on filtered profitability ROA data. The panel consists of 14 EU countries (data for Ireland had to be excluded to construct a balanced panel) and covers the period 1990 to 2008. The log-t statistics obtained for the return on asset ratio is tabulated in Appendix 7C, Table 7C.1. According to these statistics, the hypothesis of convergence in profitability is rejected at the 5% significance level (t-statistics = -5.735). These results tally with those of Gropp and Kashyap (2009) who find limited convergence in European banks' profits. However, as discussed by Phillips and Sul (2007), a strict rejection of the null of convergence may not necessarily imply that sub-club convergence is also not present. Hence, the next section discusses the Phillips and Sul club convergence test results.

7.6.2 Phillips and Sul (2007) club clustering test for profitability

The club-clustering test results present a picture of heterogeneous convergence patterns in the retail banks' profitability ratios over the period 1990-2008. As tabulated in Appendix C, Table 7C.2, three main clusters of profitability convergence are identified. The first cluster groups Finland, Greece, Spain and Sweden while the second club consists of Denmark and Italy. The third cluster comprises Austria, France, Germany, Luxembourg, Netherlands, Portugal and UK while Belgium is the only divergent country. Interestingly, the second club of countries show by far the fastest rate of convergence ($\hat{b}$=4.260) followed by the first club ($\hat{b}$=0.231). The third club of countries which groups most of the countries in the sample actually has a negative rate of convergence ($\hat{b}$=-0.661). This information on the speed of convergence lends support to the strong presence of heterogeneity in European retail banks' profitability. In addition, the specific groupings of the countries are very interesting as the sub-club members share common characteristics which could explain their profits convergence patterns.

For instance, in the first club, as reported by the European Commission (2007b), the share of gross income derived from various product lines is very similar across all four countries. Based on 2004 data, it can be observed that Finland (5.30%), Greece (4.18%), Spain (12.39%) and Sweden (8.80%) are the only four countries in the sample to derive the least amount of income from current accounts to households. In comparison, France, Germany and the UK which all belong to the third cluster derive 34.98%, 23.83% 23.77% respectively of their total income just from household current accounts. In contrast, the bulk of gross consumer income for Finland (57.45%), Greece (37.86%), Spain (54.98%) and Sweden (61.68%) all come from residential mortgages[11]. The share of gross income derived from credit cards is also very similar among the 4 countries, especially Finland and Greece. A similar picture emerges when the share of gross income from product lines to small and medium enterprises[12] (SMEs) is analysed. Once again, it can be observed that Finland, Greece, Spain and Sweden derive a much lower share of their income from current accounts to SMEs and a much higher share from SME term loans.

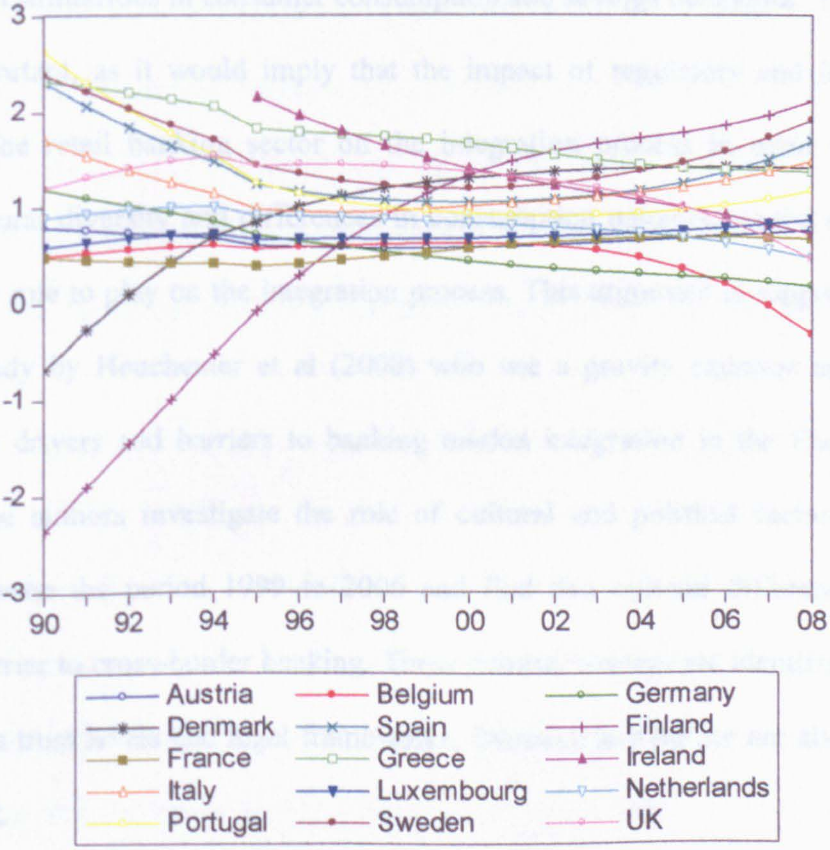
Interestingly, the distribution of gross income across the various household product lines is also very similar for banks' from countries in the second and third clusters as well (European Commission, 2007b). This, of course, underpins the consumers' consumption and savings behaviour within the individual EU countries, which, in turn, translate into various banks' profitability. Hence, based on the above analysis and data, it can be observed that consumers in Finland, Greece, Spain and Sweden have similar consumption patterns as evidenced by their high levels of mortgages. Similarly, Austria, France, Germany, Luxembourg, Netherlands also have comparable consumption patterns as shown by the high savings ratios in these countries. Consequently, the convergence in banks' profitability from these countries seems to mirror these consumption patterns.

[11] Based on 2004 estimates
[12] Based on 2004 data European Commission (2007b)

As mentioned earlier, Belgium is actually the only divergent country that has been identified by the club clustering algorithm. There seem to be two main factors that set Belgium apart from the rest of the panel. Firstly, based on Goddard et al (2009) estimates, it can be observed that the market share of individual banks out of total banks' assets is by far the highest in Belgium compared to the other EU countries. The estimates cover the period 1992 to 2007 and using their empirical model, Goddard et al (2009) prove that the link between market share and profitability for Belgium is positive and significant. This would suggest that Belgian banks can use their market share to boost their profitability. Secondly, based on the European Commission (2007b) estimates, it can be observed that Belgium derives more than half its gross income from deposits and savings to households (51.99%) which is by far the highest share of income derived in this category. This is in sharp contrast to the breakdown of gross income from the rest of the EU countries, except for the other members of the BENELUX group and Germany who also have high savings ratio. Hence these factors could well explain the divergent behaviour of Belgium's profitability ratios.

7.6.3 Profitability transition paths

Figure 7.3 Transition paths for each country's profitability (ROA) ratios for the period 1990-2008



The figure 7.3 above depicts the transition paths for each country's ROA for the period 1990-2008. Based on the log t-test, the club clustering test results and the visual inspection of the above chart, it can be concluded that heterogeneity and diversity are present in the profitability trends for the 15 EU countries. With regards to the transition paths in particular, it can be observed that certain countries, such as Finland and Denmark start well below the panel cross-section average and gradually move upwards but show no sign of converging towards one. Other countries such as Greece, Spain, and

Sweden (club 1) start way above the cross section average but gradually move closer to one.

On the whole, with regards to retail banks' profitability, sub-group convergence is identifiable and the sub-groupings of Member States into specific clusters seem to emanate from similarities in consumer consumption and savings behaviour. This finding is quite important, as it would imply that the impact of regulatory and institutional changes in the retail banking sector on the integration process in retail banking is limited. Cultural diversity and differences in consumption patterns, on the other hand, have a major role to play on the integration process. This argument is supported by the empirical study by Heuchemer et al (2008) who use a gravity equation approach to identify both drivers and barriers to banking market integration in the Euro-zone. In particular, the authors investigate the role of cultural and political factors on retail banking between the period 1999 to 2006 and find that cultural differences are an important barrier to cross-border banking. These cultural barriers are identified as being differences in trust levels and legal frameworks. Distance and border are also found to be significant.

7.7 Comparative analysis of results obtained for the convergence in banking ratios

The test convergence results obtained for the banks' cost-income ratios and efficiency scores and the profitability ratios are not very dissimilar in the sense that a degree of heterogeneity is found in all three panels. However, it can be observed that greater diversity is detected for the profitability panel. From a theoretical perspective, these results are not surprising as a positive relationship between bank efficiency and profitability is expected to be found. Hence, the higher the efficiency (generally cost efficiency) of a given bank, then the higher the profits will be. However, empirical testing on this relationship in the literature yields some conflicting results. For instance, Turati (2003) calculates the correlation coefficients between profitability (using ROE[13] and ROA) and efficiency scores for the period 1992 and 1999 for five European banks and finds that the correlation coefficients are actually close to zero. Hence this would mean that inefficient banks could still earn high profits. This would not be surprising if the market structure for the domestic banking sector is oligopolistic in nature whereby higher costs can be translated into higher prices, thus still enabling high profits to be earned.

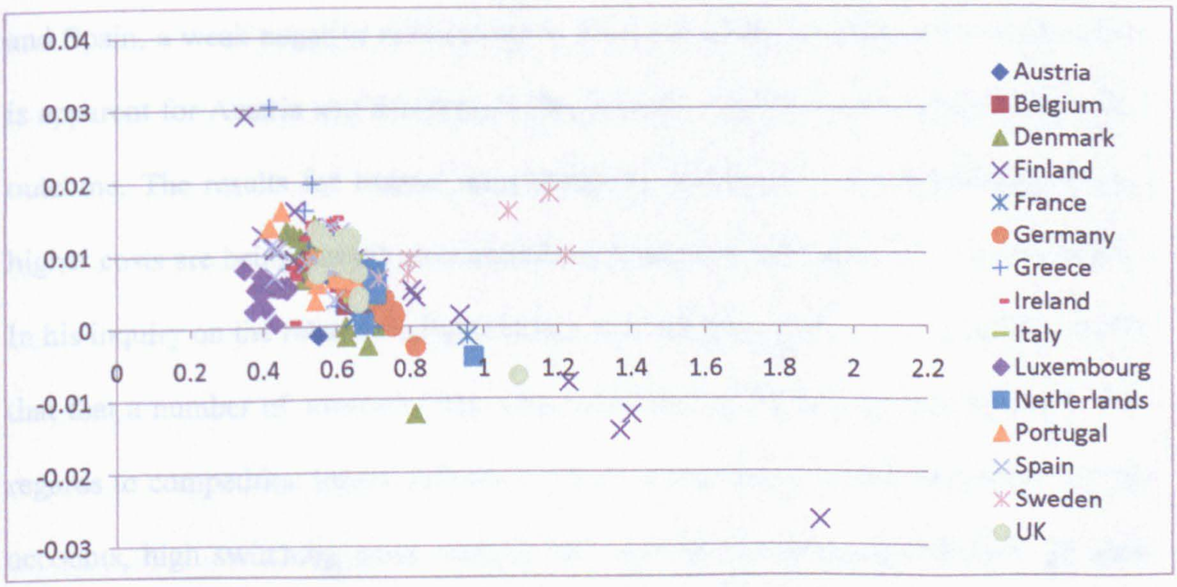
On the other hand, Goddard et al (2009) opine that a reduction in cost-income ratio is expected to improve a bank's profitability. However, the authors do concede that if banks decide to pass on the benefits of better operational profits to customers in the form of better loan rates or higher deposit rates, then profits may not rise. In the empirical testing that they conduct, Goddard et al (2009) actually find a significant negative relationship between cost-income ratio and profitability and conclude that efficiency is a more important determinant of profitability that the other tested determinants such as concentration or bank's market share.

[13] Return on equity

Given the above findings, using the computed cost income ratios and ROA ratios for the period 1990-2008, the link between efficiency and profitability for the retail banks' of the 15 EU countries is plotted in Figure 7.4 below.

Figure 7.4 Profitability and cost-income ratios for each of the 15 EU countries for 1990-2008

ROA



Cost-income Ratio

The above chart seems to point to a negative relationship between the efficiency ratio and the profitability ratio for retail banks' for most the 15 EU countries for the years 1990-2008. Based on the calculated correlation coefficients (see Table 7D.1, Appendix 7D), it can be observed that a strong negative relationship between cost-income ratio and ROA is evident for Belgium, Denmark, Finland, France, Germany, Greece, Italy, Netherlands, Portugal, UK. These results might indicate that better cost efficiency yields higher profitability. However, as argued by the European Commission (2007b), these results could also be reflecting consumption patterns across EU countries. For instance, some retail products such as mortgages can be highly profitable but also bear lower costs of supply. As discussed in the previous section, retail banks in Finland, Greece, Spain and Sweden do derive a large chunk of their gross income from mortgage and fixed term loans. Hence, it could be the consumption behaviours which largely dictate the profitability retail banks as opposed to just cost efficiency measures.

For the remaining five countries, a mixed picture emerges. In the case of Luxembourg and Spain, a weak negative relationship is observed while a weak positive relationship is apparent for Austria and Sweden. As for Ireland, a strong positive relationship is the outcome. The results for Ireland are particularly interesting, as it would suggest that higher costs are being passed on to customers without denting the high levels of profits. In his inquiry on the retail banking practices, the European Commission (2007b) reports that that a number of concerns have been raised on the Irish retail banking sector with regards to competition issues such as low price competition on interest rates on current accounts, high switching costs, and barriers to SMEs in switching suppliers for term loans. Hence, although a negative relationship seems to prevail between cost efficiency and profitability for most of the 15 EU countries, it needs to be pointed out that other factors such as consumption patterns and levels of competition are likely to have a big impact.

7.8 Conclusions

The main contributions of this chapter are twofold. Firstly, it analyses the convergence process in the retail banking sector by conducting a micro-data analysis of retail banking efficiency (cost-income ratios and efficiency scores) and profitability ratios of the 15 EU countries for the period 1990-2008. The reasoning being that within an integrating or integrated retail banking sector, the combination of competitive pressures and regulatory changes should translate into converging banks' cost efficiency and profitability. To-date, there are very few studies [see Weill (2009), Gropp and Kashyap (2009) and Goddard et al (2009)] that have actually analysed the presence of convergence in EU retail banking costs efficiency or profitability. Most studies have focused on macro-data analysis and do not cover a similar time period. Secondly, this chapter applies the Phillips and Sul (2007) method, which has not been previously employed in this area. This panel convergence method provides a flexible and powerful framework for the analysis of such data as it is based on a time varying factor representation and can establish whether convergence is present within a heterogeneous panel.

The Phillips and Sul (2007) methodologies are applied to 2 panels of efficiency data. The first panel consists of cost-income ratios which are used as a proxy for cost efficiency. These ratios have been calculated from the consolidated income and balance sheet statements for retail banks (commercial, savings and cooperative banks) from the 15 EU countries for the period 1990-2008. The second panel consists of efficiency scores which have been estimated by Weill (2009) using a stochastic frontier approach and covers 10 EU countries for the period 1994-2005. The results for the efficiency data yield some interesting findings. The log t-test rejects the null hypothesis of convergence for both cost-income ratios and efficiency scores panels at the 5% level. However, the presence of group convergence is noted for the efficiency scores panel at the 1% significance level. These results are in line with those of Weill (2009) who also finds convergence at 1% level. However, it should be noted that Weill (2009) uses a different convergence methodology, namely the beta and sigma convergence methodology. In this chapter, it is argued that the Phillips and Sul convergence method is actually more powerful and informative.

In addition, as demonstrated by Phillips and Sul (2007), it may be possible that within a heterogeneous panel, sub-groups of countries show convergent behaviour. This is indeed the case here for both the cost-income efficiency ratio panel and the efficiency scores panel data sets. For the cost income ratio panel, four sub-clusters of convergence are detected. In addition, the groupings within each cluster seem to be directly linked to shared characteristics in retail banking in the sub-group members such as similar concentration ratios, market structures and domestic market share. For the cost efficiency scores panel, only two sub-groups of convergent countries are identified; suggesting a more pronounced convergence patterns within the panel. The transition paths for the individual countries cost-income ratios underpin the findings from the club clustering tests and show an improvement in the convergence process around the period 1998/1999, which corresponds to some key regulatory events such as the introduction of the FSAP. As for the time paths for the individual countries' efficiency scores, a catching up process and a narrowing of the gap of cost efficiency within the panel is highlighted. So overall, based on the efficiency convergence tests, two main conclusions can be drawn. Firstly, it is clear that convergence within sub-clusters is evident. Secondly, the sub-grouping is more powerful for the efficiency scores than for the cost-income ratio panels. It should however, be noted that the time period covered and the number of countries in the two panels are different.

With regards to the profitability (ROA) panel, the log t-test rejects the null of convergence for the whole panel. However, the clustering tests and the transition paths for the individual countries suggest that convergence is evident at sub-club level. Hence it can be argued that there is some heterogeneity present in retail banks' profitability. Regarding the profitability sub-group convergence tests, one result warrants special mention. It is observed that household and SME's consumption patterns seem to be the determining factors behind the groupings within each cluster. This finding would suggest that national characteristics and differences in consumption behaviour may create a barrier to any further regulatory and institutional efforts at establishing a single market in retail banking. The empirical study by Heuchemer et al (2008) supports this argument.

Furthermore, based on correlation coefficients between cost income ratios and profitability ratios, a strong negative relationship between cost-income ratios and profitability seem to prevail for most of the EU countries in the sample. These results should be interpreted with caution as they could suggest several scenarios. Firstly, it can be interpreted as being the results of an integrated retail banking market whereby competition pushes banks to improve their cost efficiency and increase their profitability. An important caveat here is that even in the absence of full-fledged competition, the above scenario is plausible as long as the market for retail banking is contestable. Secondly, it may well be consumers and SMEs consumption and savings patterns are a more important determinant of banks' profitability than cost efficiency.

Appendix 7A Additional information on the sources of the efficiency and profitability data

The aggregated data used to compile the above ratios have been sourced from the income and balance sheet statements of retail banks which generally include domestic and foreign commercial banks; savings banks; and cooperative banks. Detailed institutional coverage, as compiled by the OECD, for each of the 15 EU countries is as follows:

1) Austria (1990-2008): Data relate to domestic banks including their foreign branches and subsidiaries (on a consolidated basis) and to banks of foreign countries conducting banking business in Austria. Data do not include Member State credit Institutions and Severance funds;

2) Belgium (1990-2008): From 1999 onwards, the profitability statistics include all the credit institutions governed by Belgian law; which include data for the four large credit institutions and for the foreign commercial banks which refer to credit institutions governed by Belgian law, but with foreign majority shareholding. Money market funds are excluded from the consolidated data;

3) Denmark (1990-2008): The financial statements of banks cover the activities of Danish banks and savings banks governed by the Financial Business Act. More specifically, the statistics cover domestic banks with a working capital of more than DKK 250 million (DKK 100 million up to 1996). Banks' foreign branches as well as Danish subsidiaries of foreign banks are included. Foreign subsidiaries of Danish banks and Danish branches of foreign banks are excluded. Banks in the Faroe Islands are also excluded;

4) Finland (1990-2008): Financial statements of banks relate to all deposit banks: commercial banks, foreign-owned banks, savings banks and co-operative banks. The data of the domestic banks operating in Finland covers all domestic and non-domestic branches, the domestic and non-domestic subsidiaries are not included. The subsidiaries of foreign banks operating in Finland are included, but the branches of the foreign banks are not included;

5) France (1990-2008): The financial Statements of banks cover the main categories of banks, which are institutions "generally authorised to receive on-demand deposits or term deposits of less than two years from the public". Those institutions are classified as bank, mutual or cooperative bank, municipal credit bank (branches of foreign banks are not included). Statistics on the large commercial banks cover the commercial banks (legal category) of the four main banking groups (Société Générale, BNP-Paribas,Crédit Agricole, HSBC France). Foreign-owned banks include only the French subsidiaries of foreign banks and exclude French branches of all foreign banks;

6) Germany (1990-2008): The financial statements of banks relate to all universal banks operating in Germany: commercial banks including the subsidiaries of foreign banks, large commercial banks (a sub-category of commercial banks), regional giro institutions (from 1999 called Landesbanken), savings banks, credit co-operatives and regional institutions of credit co-operatives. The data relate to German banks including their branches at home and abroad, but not to their foreign subsidiaries. The branches of foreign banks in Germany are not covered whereas the data of domestic subsidiaries of foreign banks are included in the statistics;

7) Greece (1990-2008): The financial statistics of banks only relate to commercial banks incorporated in Greece. More specifically the data is from the five largest commercial banks operating in Greece in terms of total assets and from foreign commercial banks (incorporated in Greece), and which are subsidiaries of foreign banks;

8) Ireland (1995-2008): The data is based on consolidated accounts from the following institutions: branches and subsidiaries of Irish-authorised credit institutions; branches of non-EEA credit institutions; subsidiaries of international banks; and building societies;

9) Italy (1990-2008): The statistics relate to limited company banks (including subsidiaries of foreign banks), co-operative banks, mutual banks, central credit institutions and branches of foreign banks;

10) Luxembourg (1990-2008): The financial statements of banks cover all banks established or incorporated in Luxembourg, including branches of foreign banks. Foreign-based subsidiaries and branches of Luxembourg banks are included in the figures for the profit and loss account;

11) Netherlands (1990-2008): Financial Statements of banks cover, as from 1989, universal banks, banks organised on a co-operative basis, savings banks, mortgage banks, other capital market institutions and security credit institutions. Before 1989, the data include only universal banks and banks organised on a co-operative basis. The data for the commercial banks relate to those from the four largest commercial banks;

12) Portugal (1990-2008): The financial statements of banks refer to financial statements of all commercial banks with their head-offices in national territory, and to some resident bank-like institutions. Subsidiaries of foreign banks are included. Excluded from these statistics are savings banks, mutual agricultural credit banks, branches of foreign banks and money market funds;

13) Spain (1990-2008): The financial statements of banks cover all banks encompassing commercial banks, savings banks and credit co-operatives. These statements are based on residence criteria: the data relate to Spanish banks and their activity in Spain (thus, excluding their foreign branches and subsidiaries), and to foreign banks (branches and subsidiaries) operating in Spain;

14) Sweden (1990-2008): The financial statements of banks relate to commercial banks, savings banks, co-operative banks and foreign-owned banks operating inside Sweden. Co-operative banks, which were transformed into a limited company at the end of 1991, are included with commercial banks. Also a limited number of savings banks were transformed into a limited company, which has been included in the commercial banks from 1993;

15) UK (1990-2008): The financial statements of Banks cover the world-wide operations of seven major retail banking groups operating in the UK: Barclays Group; Bradford and Bingley Group (included in the coverage beginning 1999); HSBC Bank Group; Lloyds Banking Group (comprising the former LloydsTSB Group and HBOS Group (included in the coverage beginning 1996)); Northern Rock Group (included in the coverage beginning 1997); Santander UK Group (including the former Abbey National Group , the Alliance & Leicester Group (included in the coverage beginning in 1996); Royal Bank of Scotland Group.

Notes:

- The bank efficiency and profitability ratios have been calculated from data available from the retail banks' financial statements for the period 1990-2008 accessible from OECD's online banking database available at http://stats.oecd.org/index.aspx. The data from individual retail banks have been aggregated by the OECD.

- The *Return on Assets ratio* is worked out as income before tax divided by average assets. This study chooses to use average assets so as to encapsulate any changes in assets during the fiscal year.

-The *Cost Income ratio* is worked out as operating costs divided by total income (net interest + non interest income)

Appendix 7B

Table 7B.1 Phillips and Sul (2007) Log *t* test

$$Log\left(\frac{H_1}{H_t}\right) - 2\log L(t) = \hat{a} + \hat{b}\log t + \hat{u}_t$$

Data series	$\hat{b}$	*t*-statistics
Cost-income ratio	-5.195	-5.402*
Cost efficiency scores	-0.189	-2.224*

Note:

-The Phillips and Sul (2007) log t-test were run in OxEdit using the Gauss code programmed by Sul (2007)

- For the cost efficiency ratio analysis, data for Ireland has been excluded in order to create a balanced sample

-The cost efficiency scores obtained from Weill (2009) contain data for 10 EU counties for the period 1994-2005

* Indicates rejection of the null hypothesis of convergence at the 5% significance level (critical value is -1.65). The 1% and 10% critical values are -2.33 and -1.28 respectively.

Appendix 7B Cont'd

Table:7B.2 Phillips and Sul (2007) Club Convergence Test

$$Log\left(\frac{H_1}{H_t}\right) - 2\log L(t) = \hat{a} + \hat{b}\log t + \hat{u}_t$$

Data series Cost efficiency ratio [1990-2008]	$\hat{b}$	*t*-statistics
Club 1: Belgium, Netherlands, UK	-2.433	-1.611
Club 2: France, Germany	-2.081	-1.490
Club 3: Austria, Denmark, Greece, Italy, Portugal, Sweden	0.489	10.904
Club 4: Finland, Luxembourg, Spain	2.433	14.048

Note:

-The Phillips and Sul (2007) club clustering log t-test were run in OxEdit using the Gauss code programmed by Sul (2007)

--Data for Ireland has been excluded in order to create a balanced sample.

* Indicates rejection of the null hypothesis of convergence at the 5% significance level (critical value is -1.65). The 1% and 10% critical values are -2.33 and -1.28 respectively.

Appendix 7B Cont'd

Table:7B.3 Phillips and Sul (2007) Club Convergence Test

$$Log\left(\frac{H_1}{H_t}\right) - 2\log L(t) = \hat{a} + \hat{b}\log t + \hat{u}_t$$

Data series **Cost efficiency scores [1994-2005]**	$\hat{b}$	*t*-statistics
Club 1: Luxembourg, UK	-2.063	-1.517
Club 2: Austria, Belgium, Denmark, France, Germany, Italy, Portugal, Spain	0.038	0.386

Note:

-The Phillips and Sul (2007) club clustering log t-test were run in OxEdit using the Gauss code programmed by Sul (2007)

-The efficiency scores were obtained from Weill (2009). These have been estimated using the intermediation approach and based on a stochastic frontier approach. The coverage is from 1994 to 2005 for 10 EU countries.

* Indicates rejection of the null hypothesis of convergence at the 5% significance level (critical value is -1.65). The 1% and 10% critical values are -2.33 and -1.28 respectively.

Appendix 7C

Table 7C.1. Phillips and Sul (2007) Log *t* test

$$Log\left(\frac{H_1}{H_t}\right) - 2\log L(t) = \hat{a} + \hat{b}\log t + \hat{u}_t$$

Data series	$\hat{b}$	*t*-statistics
Return on assets (ROA) ratio	-1.483	-5.735*

Note:

-The Phillips and Sul (2007) log t-test were run in OxEdit using the Gauss code programmed by Sul (2007)

- Data for Ireland has been excluded in order to create a balanced sample.

* Indicates rejection of the null hypothesis of convergence at the 5% significance level (critical value is -1.65). The 1% and 10% critical values are -2.33 and -1.28 respectively.

Appendix 7C Cont'd

Table:7C.2 Phillips and Sul (2007) Club Convergence Test

$$Log\left(\frac{H_1}{H_t}\right) - 2\log L(t) = \hat{a} + \hat{b}\log t + \hat{u}_t$$

Data series Return on assets (ROA) ratio	$\hat{b}$	*t*-statistics
Club 1: Finland, Greece, Spain, Sweden	0.231	0.753
Club 2: Denmark, Italy	4.260	3.055
Club 3: Austria, France, Germany, Luxembourg, Netherlands, Portugal, UK	-0.661	-1.572
Divergent country: Belgium		

Note:

-The Phillips and Sul (2007) club clustering log t-test were run in OxEdit using the Gauss code programmed by Sul (2007)

- Data for Ireland has been excluded in order to create a balanced sample.

* Indicates rejection of the null hypothesis of convergence at the 5% significance level (critical value is -1.65). The 1% and 10% critical values are -2.33 and -1.28 respectively.

Appendix 7D

Table 7D.1 Correlation coefficients for cost-income ratios and ROA ratios for 15 EU countries for 1990-2008

Country	Correlation coefficient
Austria	0.32
Belgium	-0.95
Denmark	-0.87
Finland	-0.95
France	-0.72
Germany	-0.94
Greece	-0.80
Ireland	0.70
Italy	-0.84
Luxembourg	-0.05
Netherlands	-0.80
Portugal	-0.66
Spain	-0.01
Sweden	0.13
UK	-0.86

Chapter 8

Conclusions

8.1 Summary of contributions and findings

The main objective of this thesis is to conduct an empirical investigation of European retail banking integration by analysing both macro and micro retail banking data for the group of EU-15 countries for the period 1990 to 2008. The macro-data analysis is performed on 19 sets of various monthly retail deposit and lending rates to the two components of retail banking, i.e. households and non-financial corporations. The micro-data analysis is performed on European retail banks' cost efficiency (cost-income ratios and cost efficiency scores), and profitability (ROA) data. The hypothesis is that the effects of the ongoing harmonisation process in the European banking sector and resulting competitive pressures can be analysed by assessing the convergence in retail banks' pricing, returns and cost efficiency.

An important contribution of this thesis is the application of methodologies that have not been previously employed in the literature on European banking integration. The analysis kick-starts with Johansen bivariate cointegration tests which are applied to all deposit and lending data series and a corresponding weighted European average. Second, using a powerful multiple stochastic break model, deposit and lending data spreads[1] are tested for structural breaks and the effects of these breaks are then removed by demeaning each individual spread data series. Subsequently, panel unit root tests, which have more power than the time series tests, are applied to deposit and lending spreads as well as the corresponding demeaned spreads. Third, the recently developed Phillips and

[1] Deposit/lending spreads are the differences between the individual deposit/lending series and the corresponding weighted European averages.

Sul (2007) panel convergence test (under which stationarity is not a prerequisite) is used to analyse the convergence process in the EU banking sector. This methodology brings a novel and key insight into the study of the European retail banking sector as it detects the degree as well as the speed of convergence. In addition, it identifies the presence of sub-clusters of countries exhibiting similar convergence and also measures the behaviour of each country's transition path relative to the panel average.

Another contribution of this thesis is the compilation of an extensive deposit and lending interest database which has been classified according to various maturities. No study has, so far, analysed such a large database for the household and non-financial corporations sectors. Furthermore, the time span covers both the 1990s and the more recent period, 2003-2008, thus enabling a comparison between the 1990s and the new millennium.

A further contribution of this thesis is the analysis of micro-retail banking data in the context of convergence. So far, there are only a couple of empirical studies that attempt to measure the convergence in European retail banking by focusing on banks' cost efficiency and profitability. The methodologies and time span in these studies are different from those of this thesis. Therefore, this thesis adds to the literature on the integration of retail banking sector with the use of a more powerful convergence methodology and updated investigation.

The main findings of this thesis are as follows. Firstly, in the application of bivariate cointegration tests to the deposit and lending rates vis-à-vis a corresponding weighted European average rate, differences are reported in the findings depending on which data set is being tested as well as which sector is being analysed. Generally, in the deposit market, more evidence of convergence is detected for the deposit instruments for the non-financial corporations compared to the deposit market for the household sector. As for the household credit and mortgage rates, the cointegration results point to limited convergence for both the 1990s and the more recent period. A similar observation is noted for the lending market for the non-financial corporations whereby on average only 20% of the countries in the sample have a cointegration equation. These results point to a fairly fragmented retail banking market and are in agreement with the earlier literature on European banking (see Centeno and Mello, 1999, Dermine, 2002, Schuler and Heinemann, 2002b).

Secondly, the presence of between 2 to 5 structural breaks is evident in every single deposit and lending interest spread series from the macro-data tested for both periods; 1991-2002 and 2003-2008. Furthermore, two main observations are made here: a), distinct clustering in the break dates for all the countries in the sample is noted; b) interestingly, it is also observed that the timings of these breaks coincide with significant milestones in the history of the European banking sector such as the launch of the FSAP, the introduction of some major Directives such as Capital Adequacy Directive and the Consumer Credit Directive. This thesis argues that these key events have triggered common shocks among the interest spreads at country-level.

When the panel unit root tests are applied to level spreads, the evidence of retail banking integration is clearly absent and in line with the cointegration results. However, in sharp contrast, the evidence based on the panel unit root test results for all the demeaned spread data sets for both the household and non-financial sectors, point to a retail integration process that started well in the 1990s. This econometric result is highly significant as it lends support to the argument that if the presence of structural breaks is left unaccounted; it could lead to wrong inferences being made on the final results.

Thirdly, the results based on the Phillips and Sul convergence tests paint a more detailed picture of the convergence process for the various retail instruments. Overall results point to an integrated i) household deposit market; ii) short to medium-term household mortgage market; iii) non-financial corporations deposit market; and iv) short-term lending market to non-financial corporations. This integration process is evident right from the 1990s and throughout the 2003-2008 period. However the speed of convergence varies depending on the maturity structure of the interest rate data. A noticeably faster speed of convergence noted for the interest rates with shorter-term maturities as opposed to longer term maturities. These results are underpinned by the club clustering tests and individual country's transition paths.

However, with regards to the consumer credit market (1995-2002 and 2003-2008); the household mortgage market for long term instruments (2003-2008); and the lending market for non-financial corporations with medium term interest rates (2003-2008); heterogeneity is detected. This is evidenced by the club clustering test results which reveal the presence of up to 3 clusters, each exhibiting a different and typically slow speed of convergence.

Generally, as argued by Phillips and Sul (2007), a slow speed of convergence cannot be detected under cointegration analysis whereas the Phillips and Sul methodology, which has more power, can detect cointegrating behaviour in these cases. Indeed, the cointegration results typically show the absence of cointegration for several data series within these categories and also among the deposit data sets. When these results are analysed together with the Phillips and Sul test results, it can be observed that the lack of time series cointegration can actually be reconciled with a slow speed of convergence. The economic rationale for these results can be linked to the importance of regional proximity, and other inherent national characteristics of retail banking such as different market structures, and various legal and regulatory frameworks. In addition, the Phillips and Sul test results do not unequivocally and strongly support the process of group convergence for all the retail deposit and lending rates as observed under the panel unit root analysis. Given that the Phillips and Sul method is better at capturing long run equilibrium while allowing for individual heterogeneity, in instances, where the results from the two panel methods diverge[2], the conclusions in this thesis are based on the Phillips and Sul results.

Another finding of this thesis is that when the convergence process for the household sector is compared with that of the non-financial corporations, two main observations can be made. Firstly, for both sectors, stronger convergence is detected for the deposit rates with shorter maturities as opposed to longer maturities. Secondly, while no group convergence is detected for the consumer credit rates for both the 1995-2002 and 2003-2008 periods, integration is detected for short-term credit rates for the non-financial corporation for the same periods. However, in both markets, greater heterogeneity is present for longer-term credit instruments. This disparity in results due to maturity duration probably reflect market expectations with regards to inflation, country-risks, growth prospects, fiscal policies, public debt, the government's credibility in managing public finances and other factors which are embedded in the expectations and liquidity preference theories. In fact, the importance of liquidity and credit risks has been particularly stressed during the recent financial turmoil.

[2] Group convergence for consumer credit rates; mortgage rates with > 10 years maturities, overdraft rates to non-financial corporations; and 1-5 years lending rates to non-financial corporations.

Another finding in this thesis relates to the convergence results on micro-data analysis. The Phillips and Sul tests are applied to cost-income ratios (proxy for cost efficiency) for the retail banks from the EU-15 countries for the period 1990 to 2008; to cost-efficiency scores estimated by Weill (2009) for 10 EU countries for the period 1994-2005; and to ROA (profitability) ratios for the EU-15 countries for the period 1990-2008. The null of group convergence, based on the log t test, is rejected for the cost-income ratio and ROA panels while convergence is detected for the cost efficiency score panel, at the 1% significance level. Based on beta and sigma convergence, Weill (2009) also finds convergence in this panel at 1% level. The club clustering test however reveals that convergence, albeit within a somewhat heterogeneous panel, is present. This is evidenced by the detection of sub-clubs of EU countries, each with convergent behaviour as well as by the transition coefficient behaviour for the individual countries. Three noteworthy observations are made on the sub-clusters and the time paths. Firstly, each cluster shows a different speed of convergence, some even exhibiting negative rate of convergence. This would actually explain the rejection of group convergence in the whole panel. Secondly, the grouping within each cluster seem to be directly linked to shared characteristics in retail banking such as similar concentration ratios and domestic market share. Thirdly, a distinct narrowing of the gap between the transition paths for the 15 countries is visible towards the end of the 1990s, which corresponds to the launch of the FSAP. This would suggest that heterogeneity in European retail banking has decreased over time, and could be linked to the efforts under the Single Market initiatives.

Overall, based on the analysis of the regulatory and legislative overhaul in the European banking sector aimed at ensuring harmonisation and promoting competition and a single market, coupled with the macro and micro data empirical analysis conducted in this thesis, it is evident that significant progress has been achieved in the European retail banking integration process. This thesis adds to this branch of literature with the use of more robust methodologies and an extensive analysis supported by economic rationale.

8.2 Policy implications

As highlighted above in Section 8.1, the retail deposit, residential mortgage, and lending to non-financial corporations markets are found to be more integrated than the consumer credit market. This thesis discusses the various limitations in the credit market such as the use of various credit registers, differences in the degree of collateralisation and especially, as discussed in Chapter 3, the complications stemming from the "minimum approach" principle behind the first Consumer Credit Directive. Once these limitations are addressed, the degree of competition and contestability in the household credit market would increase and so would the integration process. However, currently, as matters stand, the consumer credit market may remain heterogeneous for the foreseeable future.

Furthermore, the deregulation and prudential regulation exercise undertaken by the European Commission is cumbersome and lengthy and as such can potentially delay or even limit the convergence process. As evidenced in the case of many of the key banking directives, negotiations have spanned a number of years before any agreement could be reached. In addition, transposition delays by Member States and misapplication of certain provisions further complicate matters. The Deposit Guarantee Schemes Directive, the Capital Requirements Directive and the Payments Services Directives, amongst others, bear testimony to this. In particular, for the Deposit

Guarantee Scheme Directive, it is noted that the recent financial crisis has highlighted how the "minimum harmonisation approach" potentially created more uncertainties during the crisis. The European Commission has been quick in addressing this gap in the legislation by introducing a minimum coverage of Eur 50,000 which increases to Eur 100,000 in December 2010. However, this raises the issue of potential bail-out costs in the event of bank failures, especially regarding banks with international operations; the administration and funding of these schemes as well as the issue of banking supervision. Proposals are underway on these matters but it is unlikely that agreement will be reached anytime soon. For instance, with regards to the funding of deposit guarantee schemes, it is only by 2020, that financing requirements by Member States have to be achieved.

In addition, the reason why the European Commission has decided to revamp the Deposit Scheme Directive is to be better prepared in the event of a crisis. However, one could debate that deposit guarantees actually lead to moral hazard and may encourage more risky lending and worsen the crisis. Furthermore, the new banking rules under Basel III are ushering in a new era for the banking industry and it is still unclear how much the setting up of a "counter-cyclical" buffer will prove to be effective in preventing crises in the long-run.

As for the supervision of banks across borders, the recent proposal to establish a new supervisory architecture in the form of supervisory colleges has only just started, and is bound to face several hurdles along the way. For instance, the current debate on whether the activities of universal banks need to be split between retail banking and trading activities will have repercussions on the banking industry. For example, such a move would potentially trigger stronger competition in the retail banking sector.

On the whole, given the differences that are inherent in the European Union retail banking sector, any policy objective will need to address and incorporate certain factors such as market contestability, cultural differences, the existence of information asymmetries, and the strength of the bank customer relationship, amongst others. Otherwise, cross-country differences will persist.

8.3 Future research

There are potential further avenues that can be explored on the basis of the research undertaken in this thesis. Firstly, in Chapter 7, this thesis applies the convergence tests to efficiency scores computed by Weill (2009), which cover 10 EU countries for a period ending in 2005. One extension of this thesis is to calculate the efficiency scores for all the 15 EU countries for the period 1990 to 2010, thus providing up to date and robust information on the process of retail banking integration. The Phillips and Sul methodology is considered superior to other convergence tests, and its application will add weight to the analysis. This is a major research project which is beyond the scope of this thesis but which will certainly be addressed as part of the author's future research. Another extension of this research is to conduct an empirical analysing of the benefits of retail banking integration. These can be divided into microeconomic benefits such as better product choice, competitive and cheaper financial products, and easier access to credit and macroeconomic benefits of such as financial development, a boost to growth and further employment. In particular the literature on the link between further integration and growth and employment potential in the area of banking is sparse[3]. Again, this is potentially another substantial piece of research work which will be addressed in the future.

[3] See Neimke et al (2002).

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