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**Integration in European Retail Banking:
Evidence from Savings and Lending Rates to
the Household Sector**

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Integration in European Retail Banking: Evidence from Savings and Lending Rates to the Household Sector

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Abstract

The aim of this paper is to examine the integration process within the European Union retail banking sector during the period 1991-2008 by analysing deposit and lending rates to households. An important contribution of the paper is the application of the recently developed Phillips and Sul (2007a) panel convergence methodology which has not hitherto been employed in this area. This method analyses the degree as well as the speed of convergence, identifies the presence of club formation, and measures the behaviour of each country's transition path relative to the panel average. We find evidence supporting integration in the deposit and short-term mortgage markets but not in the consumer credit market and longer term mortgages. The club clustering tests suggest that the convergence process is not homogeneous among countries. In addition, it is observed that the speed of convergence is inversely related to the maturity duration for all deposit and lending rates.

Keywords: Integration; European retail banking; savings; lending rates; household sector; Phillip and Sul convergence method

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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 these have been revised and reformulated over the years to keep up with an ever-changing and dynamic market. The wholesale banking sector has been widely investigated in the literature while the retail sector to a much lesser extent. The aim of this paper is to investigate how successful the Single Market 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.

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 retail banking integration. Some of the earlier studies (Kleimeier and Sander (2000, 2003), Schuler and Heinemann (2002)), typically conduct bivariate cointegration analysis on interest rate spreads for different household lending and deposit rates. Other studies (Murinde et al, 2000, Adam et al, 2002 and Vajanne, 2007) draw from the growth literature based on beta and sigma panel convergence tests to assess the degree and speed of convergence in the retail household sector. The remaining studies (Affinito and Farabullini, 2006, Sorensen and Lichtenberger, 2007, Sorensen and Guitierrez, 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 argument that the launch of the euro, as well as the initiatives stemming from the Single Market and more recently, the Financial Services Action Plan, has 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 number of short-comings have been identified. Firstly, some of the earlier studies (see Schuler and Heinemann, 2002; Sander and Kleimeier, 2003) apply time series cointegration analysis to small samples which, as widely argued in the literature, result in a loss of power of the test. The same observation is noted for the study by Affinito and Farabullini (2006) who apply unit root tests and tests of equality on country coefficients on a sample covering 2 years only. Second, the sample periods covered in most of the studies stop in the early 2000s except for the one by Vajanne (2007) who considers a sample up to 2006. The empirical model used by Sorensen and Lichtenberger (2007) also considers data up to 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. Third, none of the studies on retail banking integration uses an actual test of convergence except for the application of beta and sigma convergence tests drawn from the growth literature¹. However, even with the beta and sigma convergence methodology, limitations have been identified. For instance, as argued by Quah (1996), 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. Hence these convergence tests do not enable the analysis of the behaviour of each individual country series over time. Also, as argued by Islam (2003), β - and σ - convergence are more relevant within the context of growth literature and he has uncovered problems that arise when empirical analysis of convergence are conducted using these methodologies.

We make two major contributions to the literature. First, we present 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

¹ Developed by Barro (1991) and Barro and Sala-i-Martin (1992) in the growth literature. β convergence measures the speed of convergence while σ convergence measures the degree of convergence. These convergence tests have been used by Adam *et al* (2002) and Vajanne (2007).

and the 1990s. Second, we apply the recently developed powerful panel convergence methodology by Phillips and Sul (2007a)², which has not been previously employed in this area. This test of convergence, termed as the *logt test*, is ideally suited for this paper for the following reasons. Firstly, this methodology provides an empirical modelling of long run equilibria within a heterogeneous 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. This information is obtained through the computation of each country's relative transition parameter and the depiction of its transition path which portrays the country's behaviour relative to the panel cross-section average over time. This is very significant as it can potentially uncover situations where individual countries may be diverging even if as a whole group, convergence is detected.

The rest of the paper is organised as follows: section 2 outlines the Phillips and Sul (2007a) convergence methodology. Section 3 describes the datasets used. Section 4 presents the empirical results, while section 5 concludes.

2. Empirical methodology

In this paper we take the view that integration in retail banking is a process whereby segmented markets become unified and open and where there is a tendency for prices of financial assets to converge over time. The Phillips and Sul (2007a) convergence panel methodology has not been previously used in the context of the EU retail banking sector and its application brings a new dimension to the study of European banking integration³. The

² See an application in Phillips and Sul (2007b, 2009)

³ A few recent studies have used the Phillips and Sul (2007a) model within the context of the European financial market namely, Caporale et al (2009) who investigate convergence in stock returns for 5 EU countries;

Phillips and Sul (P&S) 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, however, be able to detect the presence of co-movement and convergence. This methodology can thus be described as an asymptotic cointegration test that models long run equilibrium while allowing for individual heterogeneity which can evolve over time. In particular, this feature of the Phillips and Sul methodology makes it superior to the beta and sigma convergence test as the P&S test allows for both common and individual heterogeneity. Furthermore, 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 extent and speed of the integration level in the group of countries through the process of club formation.

2.1 *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:

$$X_{it} = g_{it} + a_{it} \tag{1}$$

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 (1) such that common and idiosyncratic components are separated as follows:

$$X_{it} = \left(\frac{g_{it} + a_{it}}{\mu_t} \right) \mu_t = \delta_{it} \mu_t \quad \text{for all } i \text{ and } t, \tag{2}$$

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.

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:

$$h_{it} = \frac{X_{it}}{\frac{1}{N} \sum_{i=1}^N X_{it}} = \frac{\delta_{it} \mu_{it}}{\frac{1}{N} \sum_{i=1}^N \delta_{it} \mu_{it}} = \frac{\delta_{it}}{\frac{1}{N} \sum_{i=1}^N \delta_{it}} \quad (3)$$

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 (3) 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 paper the value of lamda is set to 14400, as suggested in the literature⁴ for monthly data.

2.2. 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

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

⁴ For instance, in Eviews, the default value for lamda is 14400 for monthly data.

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:

$$H_t = \frac{1}{N} \sum_{i=1}^N (\hat{h}_{it} - 1)^2 \quad (4)$$

Step 2: The following OLS regression is performed:

$$\text{Log} \left(\frac{H_1}{H_t} \right) - 2 \log L(t) = \hat{a} + \hat{b} \log t + \hat{u}_t \quad (5)$$

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 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 $t_{\hat{b}} < -1.65$.

2.3. 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 paper, 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^5 , 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.

3. Data sets and variable definitions

Eleven monthly deposit and lending interest rate data sets for the households have been compiled for up to 15 EU countries⁶ for the purpose of this paper. Due to limited availability

⁵ 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 paper ranges from 72 to 142, c is set at 0.

⁶ 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).

of data for the other EU countries, the empirical analysis conducted in this paper focuses on the group of 15 EU 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 European Central Bank's (ECB) 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 have been compiled for the household sector:

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

4. Empirical results

4.1. Phillips and Sul (2007a) log t -test⁷

Phillips and Sul (2007a) 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)

⁷The Gauss codes for the computation of the log t test and convergence clubs are available from Sul's website, <http://homes.eco.auckland.ac.nz/dsul013/>.

filter is thus employed for this purpose. 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 1. 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.

First, 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 ($\hat{b} = 1.607$) for the deposit rates with the short-term maturities for the 2003-2008 period while the slowest rate of convergence ($\hat{b} = 0.102$) is noted for the deposit rates with the highest maturity duration for the same period.

Second, 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 2000-2008. These results are not surprising given the highly segmented consumer credit market in the 1990s 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. For instance, with regards to legislations, the Consumer Credit Directive which was adopted in 1987 was based on the principle of minimum harmonisation. This resulted in Member States establishing different national legislation which in turn, became obstacles to the provision of pan-European products (European Commission, 2005). 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).

In addition, the credit reporting systems across the EU is quite diverse. As reported by the Expert Group on Credit Histories in the Member States, there are generally three main types of credit reporting systems; private systems, public systems and dual systems (combination of public and private systems) (European Commission, 2009). 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 only rolled out in the years 2000s mostly.

Moreover, 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. 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. Overall, these factors may be responsible for the absence of panel convergence, as evidenced by the log t -test.

Third, 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. The group convergence 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. Their analysis is based on an error correction model that looks at long term mortgage rates in ten⁸ 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.

Hence, 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

⁸ AT, BE, DE, ES, FI, FR, GR, IE, IT, LUX, NL, PT

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.

4.2. 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. Hence, retail banking 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. The test statistics are reported in Table 2, 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.

4.2.1. Short term deposit rates: 1991-2002

As discussed in Section 4.1 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 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 in Figure 1, some interesting observations can be made.

For instance, 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 behaviour and this can actually be linked to the heterogeneous nature of the domestic retail market in these countries. For instance, the lack of convergence for the deposit rates series for Ireland can be attributed to a lack of competition such as little price competition paid on personal current accounts, high switching costs and unclear procedures with regards to admitting new members to the payment clearing system. This would act as a disincentive for new entrants. 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). In Spain, on the other hand, savings banks have to uphold social obligations and channel funds to community and social projects. More specifically, these banks must allocate at least half of their profits to reserves and the rest to social projects. In Netherlands, on its part, it is cooperative banks that dominate the domestic retail banking landscape. As an example, Rabobank, a large cooperative bank, takes almost 40% of all private savings (European Commission 2007). Overall, 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.

4.2.2. *Deposit rates (1 year maturity): 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 2, 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.

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 one. 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.

4.2.3. *Deposit rates (1-2 years' maturity): 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 in the behaviour of the panel of countries' transition paths (Figure 3). It can be observed 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 4.2.2, can be cited as explanations for such behaviour.

4.2.4. *Deposit rates (>2years' maturity): 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 ($\hat{b} = 1.523$). These results point to a mixed picture on the convergence process for this dataset this observation is also highlighted in the illustration of each country's transition path for this panel (see Figure 4). It is clearly visible that the 14 EU countries have different convergence behaviour over the whole period.

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.

4.2.5. *Consumer credit rates: 1995-2002*

As discussed in Section 4.1, 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 in Figure 5, 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 Section 4.1.

4.2.6. *Consumer credit rates (1 year maturity): 2003-2008*

Along similar lines as the findings discussed in Section 4.2.5 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 6). No specific clustering around the cross-section average can be detected for this panel of countries. 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.

4.2.7. *Consumer credit rates (1-5 years' maturity): 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 7) 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.

4.2.8. *Mortgage rates (2-5 years' maturity): 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 ($\hat{b}=0.333$).

As seen in Figure 8, 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 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.

4.2.9. *Mortgage rates (1-5 years' maturity): 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 transition paths for the short-term mortgage rates, shown in Figure 9, 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 4.2.2.

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 in Figure 9 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).

4.2.10. Mortgage rates (5-10 years' maturity): 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. The transition paths, as illustrated in Figure 10, for the mortgage rates with medium term maturities show general similarities between the countries in the sample, with some 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 4.2.9 provide an interpretation for these two countries' paths.

4.2.11. Mortgage rates (> 10 years' maturity): 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. Along the same vein, the transition paths depicted in Figure 11, 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. Based on 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, this paper puts forward the view that no convergence is present for longer-term mortgage rates in the EU retail banking sector.

5. Conclusions

The aim of this paper 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 paper is the application of the Phillips and Sul (2007a) convergence methodology, which has not been previously employed in the literature on European banking integration. The use of this panel test is a major contribution of this paper as the Phillips and Sul (2007a) 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 (2007a) regression-based tests of convergence provide both flexibility and robustness due to the time varying factor representation. This panel methodology is superior to the commonly used time series cointegration approach and other convergence methods such as the beta and sigma convergence tests as it models long run equilibrium while allowing for individual heterogeneity over time. Hence, this procedure brings a novel and deeper insight into the study of the European retail banking sector.

The main findings of the paper are as follows. First, convergence is detected in the retail banking sector for the household market, especially in the deposit and short-term to medium-

term mortgage markets. Based on results obtained, it can be asserted that this convergence process has mostly gathered momentum in the late 1990s and shows unimpeded growth up to the end of the sample period, i.e. 2008. Second, the consumer credit market shows signs of being the most heterogeneous market throughout the sample period (1991-2008). A slow speed of convergence is detected at sub-group level but none is found at group level. Based on the club convergence results, geographical proximity and similarities in structural characteristics may be the determining factors in this case. Third, another notable fact is that relatively faster speed of convergence is observed for the panels with shorter maturities compared to the longer term ones. This is evident for all the different panels of deposit, consumer credit and mortgage rate data but even more so for the panel on mortgage rates with the longest maturities, which exhibit outright divergent behaviour. We put forward several arguments drawn from a theoretical perspective on the term structure of interest rates such as the expectations and liquidity preference theories in support of this finding. Fourth, while group convergence is identified for most panels, the club clustering tests and the countries' transition paths reveal that the convergence process within the panel of 15 EU countries is not homogeneous. Indeed, club formation is detected within 6 out of the 11 panels; with countries typically moving in and out of clusters. The transition paths also illustrate some diversity in the convergence patterns especially for instruments with longer maturity durations.

Our empirical results highlight some policy implications. For instance, we find that the credit market is heterogeneous and associate it with various limitations such as the use of different credit registers, differences in the degree of collateralisation and 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, on the whole, any policy initiative will not only have to address market contestability but also cultural differences, the existence of information asymmetries, and the strength of the bank customer relationship, amongst others. Otherwise, cross-country differences will persist.

References

Adam K., Jappelli T., Menichini A., Padula M., Pagano M. (2002), "Analyse, compare and apply alternative indicators and monitoring methodologies to measure the evolution of capital market integration in the European Union", *Centre for Studies in Economics and Finance, University of Salerno*, January.

Affinito M. and Farabullini F. (2006), "Does the law of one price hold in retail banking? An analysis of national interest rate differentials in the euro area", *Bank of Italy, Economic Research Department*, August.

Antzoulatos A., Panopoulou E., Tsoumas C. (2008), "The enigma of non-interest income convergence, Department of Banking and Finance", *University of Piraeus*.

Barro, R.J. & Sala-i-Martin, X., (1991), "Convergence Across States and Regions", *Yale - Economic Growth Center*, paper No. 629.

Barro R. J., Sala-i-M. (1992), "Convergence" *Journal of Political Economy*, Vol. 100, No. 2, pp. 223-251.

Bondt G., Mojon B., and Valla N. (2005), "Term structure and the sluggishness of retail bank interest rates in Euro area countries", *ECB Working paper series No.518*.

British Bankers' Association (BBA) (2004), *A UK Retail banking manifesto: addressing the challenges that lie ahead for the industry and its stakeholders*.

Caporale G. M.; Erdogan B.; and Kuzin V. (2009), Testing for Convergence in Stock Markets: A Non-Linear Factor Approach, CESifo Working Paper Series, No. 2845, Munich.

Doornik, J.A. (2005), *Object-Oriented Matrix Programming Using Ox*, 3rd ed. London: Timberlake Consultants Press and Oxford, Available from : www.doornik.com.

European Commission (2005), *Modified proposal for a Directive of the European Parliament and of the Council on credit agreements for consumers amending Council Directive 93/13/EC*, (online) Available from:

http://ec.europa.eu/consumers/cons_int/fina_serv/cons_directive/2ndproposal_en.pdf

[Accessed 18th May 2010]

European Commission (2006), *Interim Report II: Current accounts and related services - Sector Inquiry under Article 17 Regulation 1/2003 on retail banking*.

European Commission (2007), *Report on the retail banking sector inquiry*, Commission staff working document, COM (2007) 33 final.

European Commission (2009), *Report of the Expert Group on Credit Histories*, DG Internal Market and Services, May.

ECB (2006), *Differences in MFI interest rates across Euro Area countries*, September.

European Mortgage Federation (EMF) (2009), *HYPOSTAT 2008: A review of Europe's mortgage and housing markets*, European Mortgage Federation.

Fischer C. (2009), "Price convergence in the EMU? Evidence from micro data", *Deutsche Bundesbank, Research Centre, Discussion Paper Series 1: Economic Studies*, No. 2009,06.

Gropp R., Sorensen C., Lichtenberger J., (2007), "The dynamics of bank spreads and financial structure", *ECB working paper* No. 714.

Higson C., Holly S. And Petralla I. (2009), "The financial integration of the European Union: common and idiosyncratic drivers", Working paper D.1.1d, *European Commission, 7th Framework Programme*.

Hodrick R. and Prescott E. (1997), "Postwar U.S. business cycles: An empirical investigation", *Journal of Money, Credit and Banking*, 29(1), 1-16.

Islam N. (2003), "What have we learnt from the convergence debate?" *Journal of Economic Surveys*, Blackwell Publishing, vol. 17(3), pages 309-362, 07.

Kleimeier S. and Sander H. (2000), "Regionalisation versus globalisation in European financial market integration: Evidence from co-integration analysis", *Journal of Banking and Finance*, 24, 1005-1043.

Kleimeier S. and Sander H. (2003), "European financial market integration: Evidence on the emergence of a single eurozone retail banking market". *Research in Banking and Finance*, 3, 13-91.

Lannoo K. and Munoz A. (2004), "Integration of the EU consumer credit market: proposal for a more efficient regulatory model", *CEPS working document*, No. 213, November.

Martin-Oliver A., Salas-Fumas V. and Saurina J. (2007), "A test of the law of one price in retail banking" *Journal of Money, Credit and Banking*, Vol. 39, Issue 8.

Miles D. (2003), "The UK mortgage market: taking a longer-term view; Interim Report: information, incentives, pricing", *HM Treasury*.

Murinde V., Agung J. and Mullineux A. (2000), "Banking system convergence in Europe", *University of Birmingham*, September.

Pesaran, M. H., (2007), "A simple panel unit root test in the presence of cross-section dependence", *Journal of Applied Econometrics*, 22(2), pp. 265-312.

Phillips P. C. B. and Sul D. (2007a), "Transition modelling and econometric convergence tests", *Econometrica* 75(6), 1771-1855.

Phillips P. C. B. and Sul D. (2007b), “Some empirics on economic growth under heterogeneous technology”, *Journal of Macroeconomics* (29) 455-469.

Phillips P. C. B. and Sul D. (2009), “Economic Transition and Growth”, *Journal of Applied Econometrics*, Vol. 24, Issue 7, pp 1153-1185.

Pilbeam K. (2010), *Finance and financial markets*, Palgrave Macmillan.

Polster A. (2004a), “Savings bank reform in Sweden pays off: overall banking market benefits from privatisation and consolidation”, *EU Monitor* No. 14.

Polster A. (2004b), “Italy’s savings banks: first reforms create big universal banks with untapped potential”, *EU Monitor* No. 17.

Quah D. (1996), “Empirics for economic growth and convergence”, *European Economic Review*, Vol. 40, pp1353-1376.

Schuler and Heinemann (2002), “How integrated are European Retail financial markets? A cointegration analysis”, *ZEW papers*, Germany.

Sørensen C. K. and Gutiérrez J., (2006), “Euro area banking sector integration – using hierarchical cluster analysis techniques”, *Working Paper Series 627*, European Central Bank.

Sørensen C. K. and Lichtenberger J.D (2007), “Mortgage interest rate dispersion in the euro area”, *Working Paper Series 733*, European Central Bank.

Sorensen C., Werner T. (2006), “Bank interest rate pass-through in the Euro Area: a cross country comparison”, *ECB working paper* No. 580.

Sul D. (2007), *Gauss codes for the computation of the panel convergence logt test and convergence clubs*, proposed in Phillips and Sul (2007a).

Vajanne L. (2007), “Integration in euro-area retail banking markets –convergence of credit interest rates”, *Bank of Finland Research Discussion paper* No. 27.

Table 1. Phillips and Sul (2007a) Log t test

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

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: a) The Phillips and Sul (2007a) log t -test were run in OxEdit using the Gauss code programmed by Sul (2007);

b)* Indicates rejection of the null hypothesis of convergence at the 5% significance level;

c) The results are generated using Ox version 4.00 (see Doornik, 2005).

Table 2. Phillips and Sul (2007a) Club Convergence Test

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

Data series	\hat{b}	<i>t</i> -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 2 Cont'd		
Data series	\hat{b}	<i>t</i> -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: a) The Phillips and Sul (2007a) club clustering log t-test were run in OxEdit using the Gauss code programmed by Sul (2007).

b) * Indicates rejection of the null hypothesis of convergence at the 5% significance level.

c) The results are generated using Ox version 4.00 (see Doornik, 2005).

Figure 1. Transition paths for each country's ST deposit rates (1991-2002)

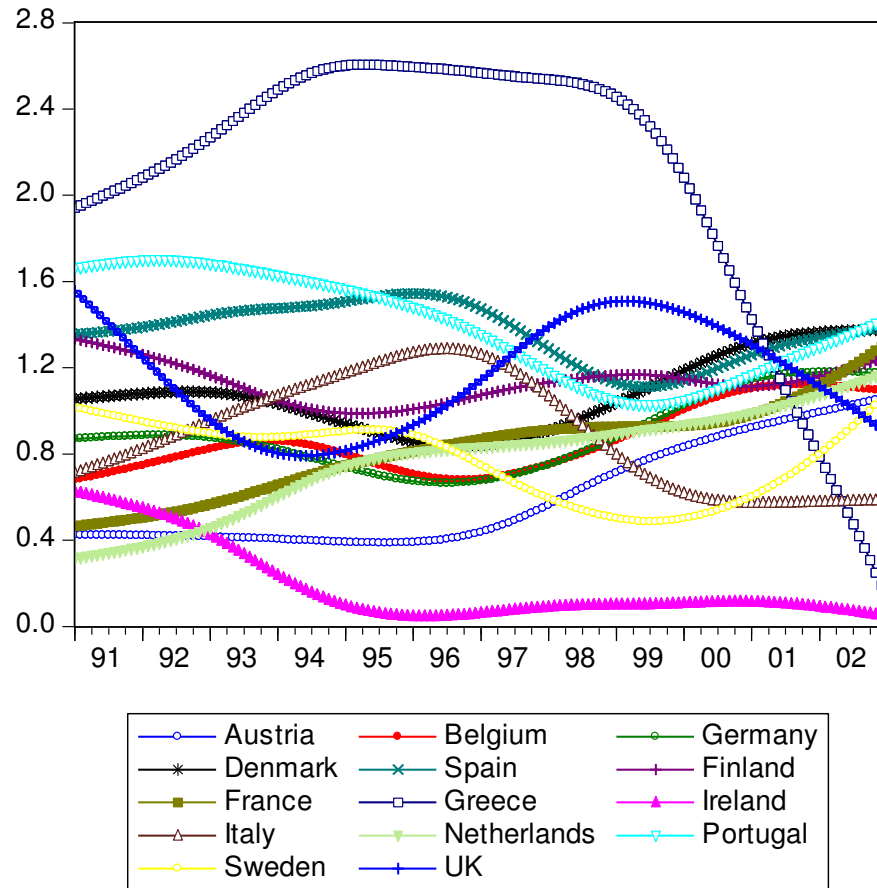


Figure 2. Transition paths for each country's 1yr deposit rates (2003-2008)

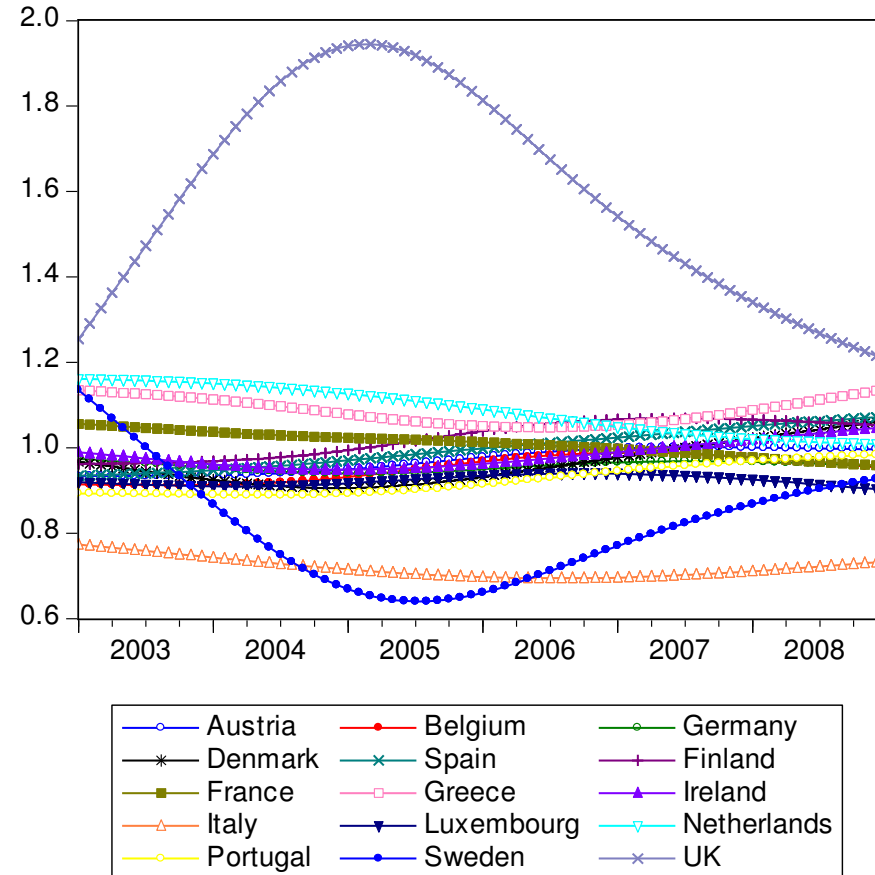


Figure 3. Transition paths for each country's 1-2yrs deposit rates (2003-2008)

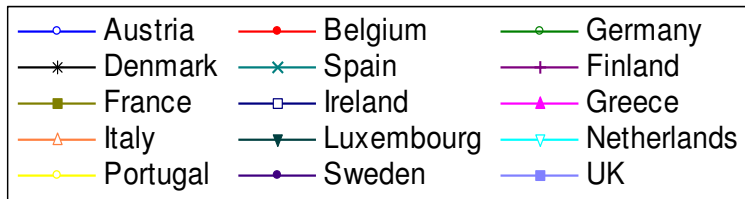
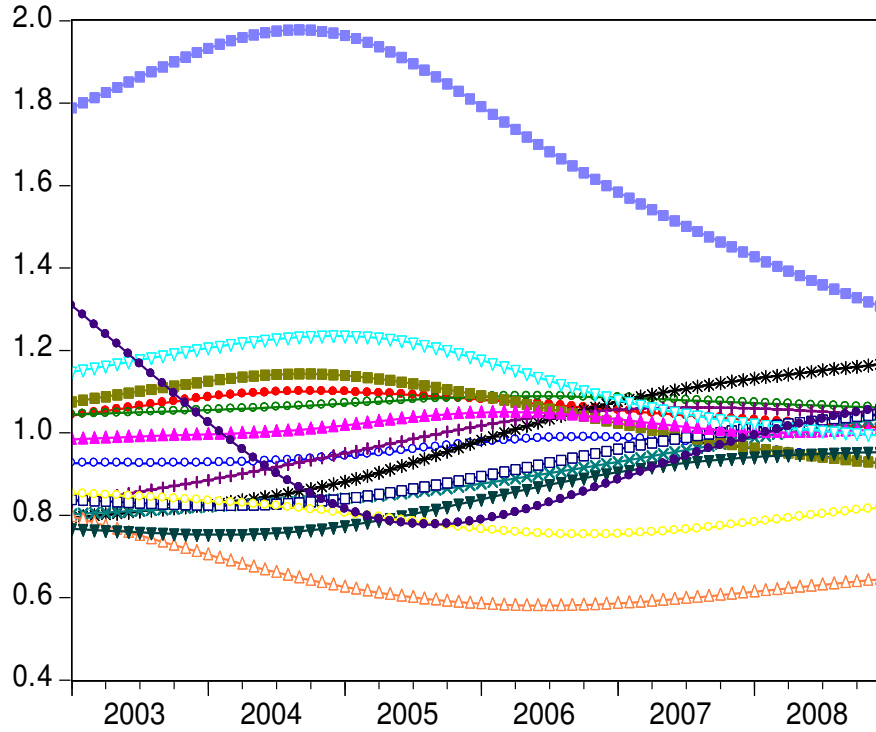


Figure 4. Transition paths for each country's >2yrs deposit rates (2003-2008)

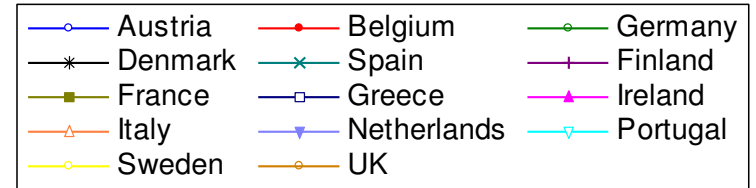
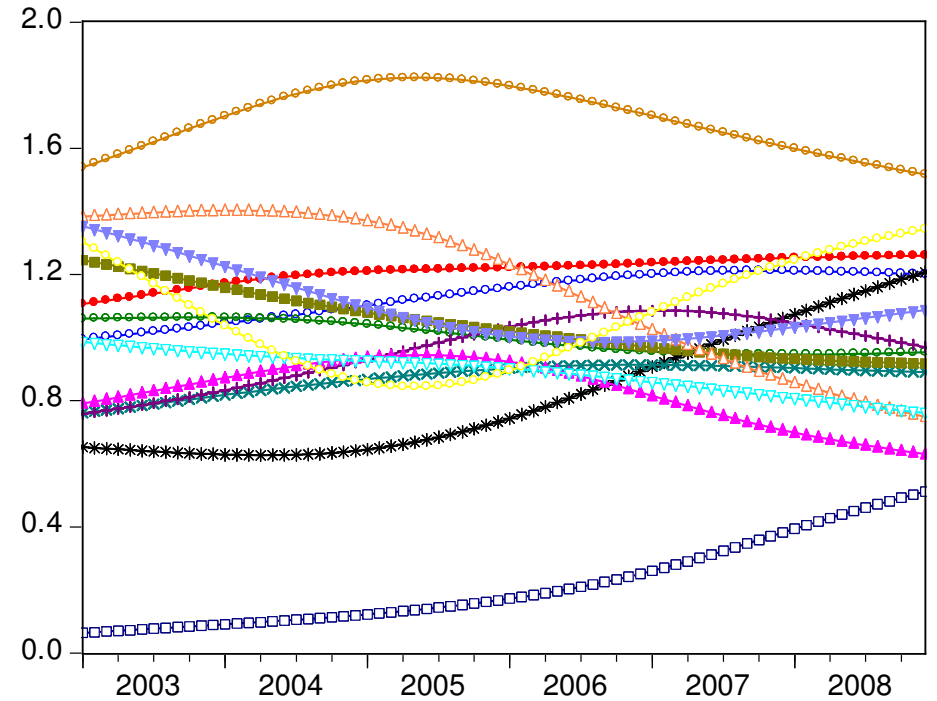


Figure 5. Transition paths for each country's consumer credit rates (1995-2002)

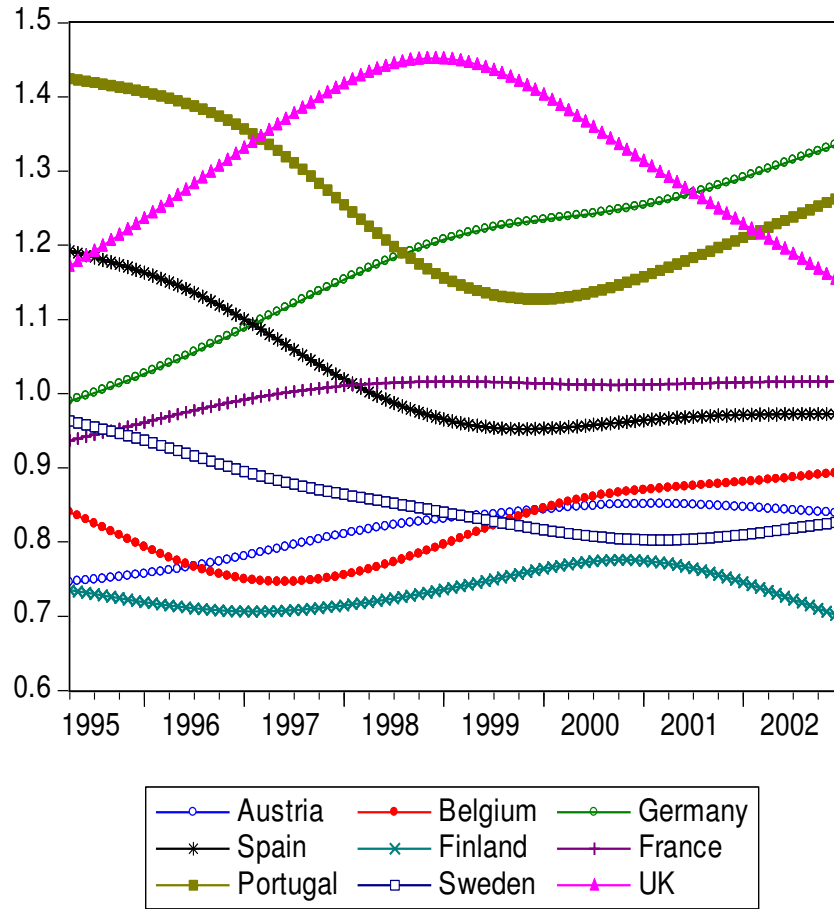


Figure 6. Transition paths for each country's 1yr consumer credit rates (2003-2008)

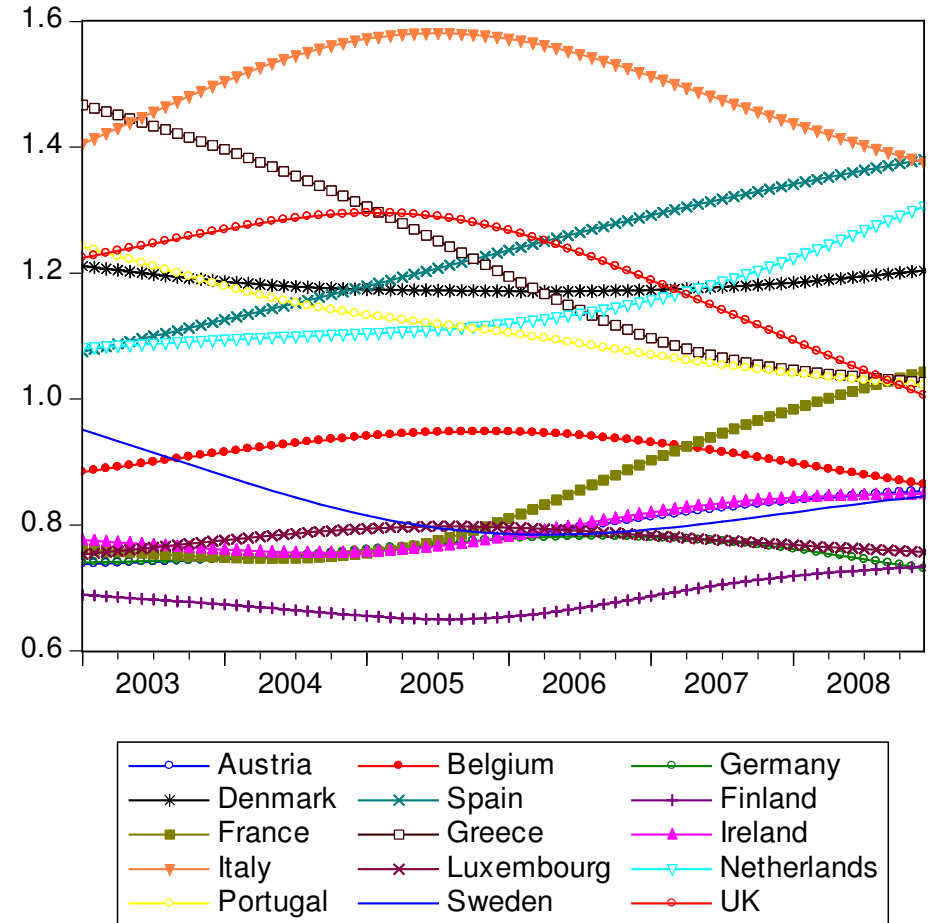


Figure 7. Transition paths for each country's 1-5yrs consumer credit rates (2003-2008)

Figure 8. Transition paths for each country's 2-5yrs mortgage rates (1995-2002)

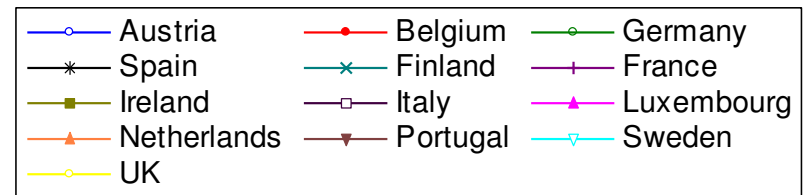
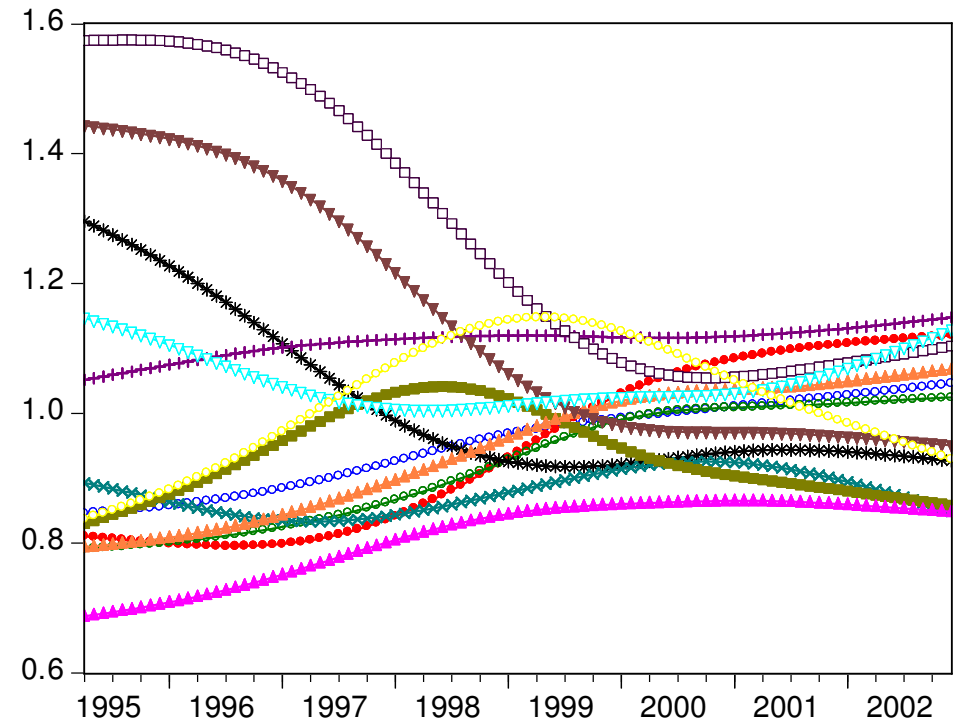
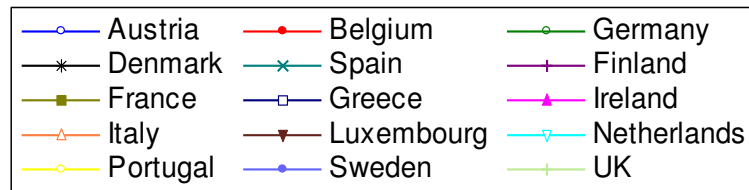
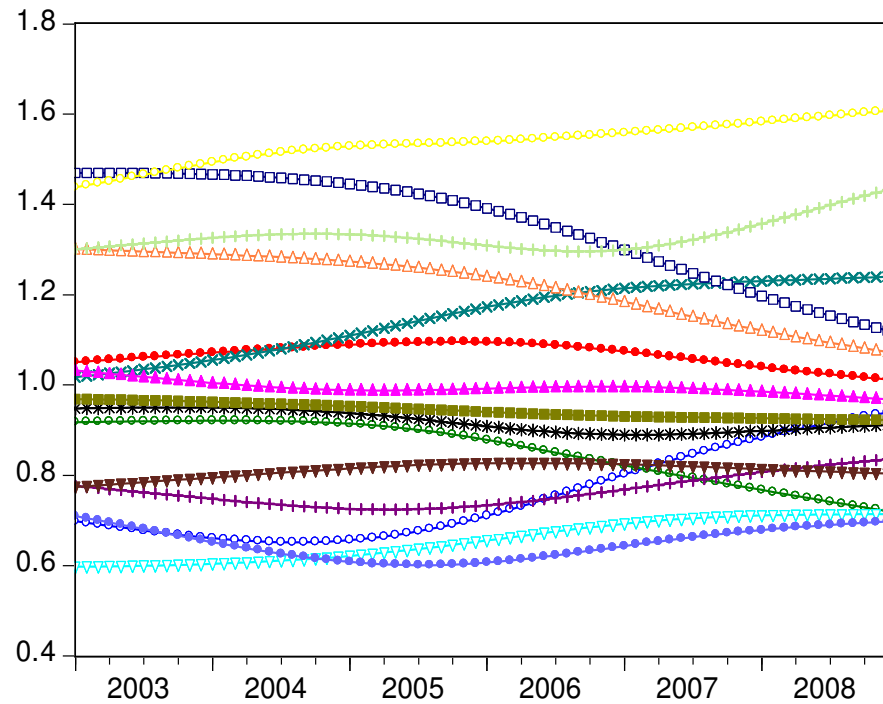


Figure 9. Transition paths for each country's 1-5yrs mortgage rates (2003-2008) Figure 10. Transition paths for each country's 5-10yrs mortgage rates (2003-2008)

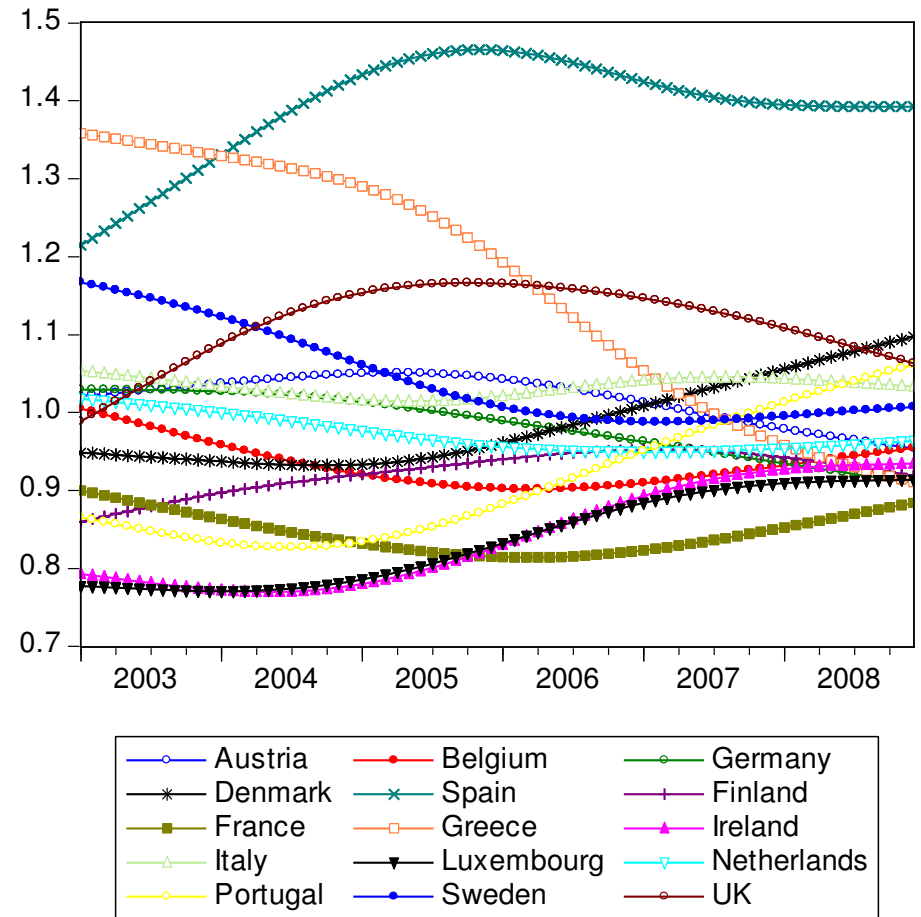
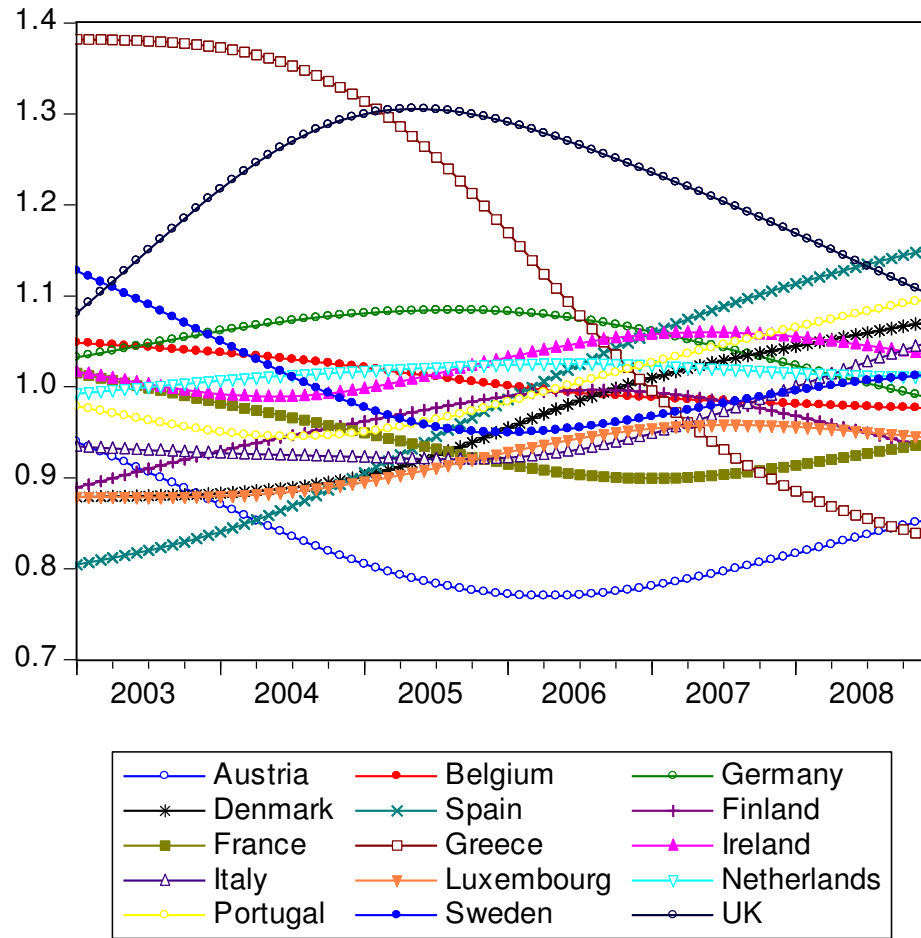


Figure 11. Transition paths for each country's >10yrs mortgage rates (2003-2008)

