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Abstract

This paper provides empirical evidence of the financial integration of some developed countries, mostly in the European Union, covering the period between 1961 and 2008.

The main contributions are to be found first, in the application of panel estimates and test statistics. particularly of some recently developed tests like the Westerlund (2007) bootstrap cointegration tests and the Pesaran (2004) test of cross-sectional independence, using the available AMECO series of nominal and real long-term and short-term interest rates as well as the yield curve; secondly, in the comparison of the approximations between the countries' series of rates and those of two chosen benchmarks: the German and US rates, for six panels of EU and some non-EU countries during three specific time intervals.

The obtained results allow us to draw conclusions not only on the quite high degree of approximation towards the benchmark rates, particularly those of Germany, but also on the differences in the patterns of this approximation before and after the implementation of the Single Market Program and of the EMU. Furthermore, we draw conclusions on some specific characteristics of the considered series of rates and, in particular, of the yield curves.

Keywords: Financial integration; European integration; panel estimates; cointegration tests.

JEL Classification: C33; E43; E44; F36.

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1. Introduction

Since the 1970s, and particularly after the collapse of the Bretton Woods system, followed by the first acute, deep oil crisis, there has been a global trend to reduce the barriers to free international trade, to increase direct foreign investment and also to establish a clear process of international financial liberalisation (Dooley, 1996; Obstfeld, 1998; Maggi, 1999; Mansfield et. al. 2000, Rose and Wincoop, 2001; Baier and Bergstrand, 2007).

In Europe, over the past half-century, a remarkable process of integration has taken place with the aim of guaranteeing the stability and security of the continent. This process started with the common undertaking of six countries to create the European Coal and Steel Community in 1951, the forerunner of the European Economic Community (EEC) which was established in 1958. By 2007, the EEC had evolved into the European Union (EU), incorporating 27 member-states.

At the same time, and at least since the 1960s, there were proposals for a single currency as a way to enhance the process of integration of the member-states. However, it was only in the 1992 that the Maastricht Treaty led to the creation of the single European currency - the euro - and the European Monetary Union (EMU).

The establishment, first, of the Single Market Program and then, of the EMU was supposed to accelerate the process of consolidation and economic and financial integration not only between the countries in the euro area but also in the European Union as a whole. The process of financial integration is also quite often presented as a necessary pre-requisite for the adoption of the euro and the implementation of the single monetary policy, with the predominance of the banking intermediation in the context of the EU (Cabral et al., 2002; European Central Bank, 2003; Hartman et al., 2003; Baele et al., 2004; Sørensen and Gutiérrez, 2006).

However, there is no clear consensus on the evidence of increasing consolidation and integration of the European markets and some empirical studies have even concluded that the European financial markets are far from being integrated (Monti, 1996; Gardener et al., 2002, Affinito and Farabullini, 2006; European Central Bank, 2007; European Central Bank, 2008; Gropp and Kashyap, 2008).

One of the explanations for the lack of consensus is to be found in the fact that financial integration is a complex process. The adopted European Central Bank's (ECB) definition of this

process is theoretically linked to the law of one price and the notion that "financial integration in euro area financial markets is achieved when all economic agents ... face identical rules and have equal access to financial instruments or services in those markets" (Baele et al. 2004, pp. 5).

This definition has direct and important implications for the methodologies and measures that are usually adopted in the degree of integration across the different market segments. The analysis uses a set of quantitative indicators of financial integration which require available and fully compatible series of data. So the empirical studies face a particular dilemma: either to use longer series for a small number of countries, or to use sets including more countries, but for only relatively short time periods.

This paper endeavours to overcome the above-mentioned dilemma by using the available AMECO series of nominal and real long-term and short-term interest rates, as well as the yield curves. It contributes to the empirical research into the degree of financial integration across different sets of EU and some non-EU countries and the time period between 1961 and 2008.

The main questions to be answered are:

1) In a world of international financial liberalisation, is there a clear process of European integration and is it more relevant than the global process of integration? In attempting to answer this question, we not only always include some non-European countries in our panels, but also choose two particular benchmarks: the German and US rates.

2) Is it possible to identify different patterns of approximation towards the benchmark rates for different panels of more or less homogeneous countries over particular time intervals? Our panels begin with only 9 EU countries and end with 25 EU countries, taking into account the possible influences of the implementation of the Single Market Program after 1985 and the inception of the EMU in 1999.

3) Are there any differences in the patterns of approximation towards the benchmarks of the nominal, real long-term or short-term interest rates, or of the yield curves? Here, we use all available AMECO interest rate and yield curve series, differentiating not only the short-term from the long-term rates, but also the nominal from the real ones, using both the private consumer and the GDP deflators.

The remainder of this paper is structured as follows. The next section presents the methodological framework and the data. Section 3 reports the obtained results with "first" and "second" generation panel unit root and cointegration tests. The cross-sectional independence test, which was applied after panel fixed-effects estimates, is presented in Section 4. Section 5 reports the obtained results with three-stage panel estimations. Section 6 concludes.

2. Methodological Framework and Data

From the existing literature on measuring financial integration, we mainly follow the important contributions of Adam et al. (2002), Adjaouté and Danthine (2003) and Baele et al. (2004). These authors present several price-based and quantity-based indicators and models which may be adapted to the empirical measure of financial integration through yield differences in individual countries or markets.

Taking into account that, theoretically, in a perfectly integrated market we would have an ideal yield, one of the proposed measures could be the comparison between a particular (country, market or segment) yield and the ideal one. Since the ideal yield is not observable, Adam et al (2002) and Adjaouté and Danthine (2003) propose a second-best alternative, using a determined benchmark yield as a proxy for the ideal one.

Another method that is widely used in this type of study (among others by Adam et al., 2002; Hartmann et al., 2003; Baele et al., 2004 Sander and Kleimeier, 2004; Vajanne, 2007; European Central Bank, 2007 and 2008) adapt the beta, and sometime also the sigma, convergence models that are borrowed from the literature on economic growth.

In the present paper, we will adapt these models and as we aim to compare the degree of integration among EU countries and some non-EU countries, we will always consider two possible benchmarks: the German and US yields or interest rates.

We apply the following general regression model to our panels with n series, for i countries and t time periods:

$$R_n = \alpha_n + \beta_n \Delta_{nb} + \varepsilon_n \qquad [1]$$

Where, for all n series we have:

α_n = intercept
R_n = the particular yield or interest rate

Δ_{nb} = the differences between each country's rate and one of the benchmark's rate.
ε_n = error term

The use of the available AMECO series is a guarantee for the compatibility of all data. We select the series of nominal and real (both by private consumption and the GDP deflators) long-term and short-term interest rates, as well as the yield curves. They allow us to compare the evolution of the degree of integration between some EU and a few, but relevant, non-EU countries in different time periods.

We will consider six panels of countries in three time intervals:

1) A panel with 432 observations for 48 years (1961-2008) and 9 EU countries (Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Sweden and the United Kingdom);

2) A panel with 480 observations for the same 48 years (1961-2008) and 10 countries (the above EU-9 plus the USA);

3) A panel with 336 observations for 24 years (1985-2008) and 14 EU countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, the United Kingdom);

4) A panel with 408 observations for the same 24 years (1985-2008) and 17 countries (the previous EU-14 plus Japan, Norway and the USA);

5) A panel with 250 observations for 10 years (1999-2008) and 25 EU countries (all the actual EU members except Luxembourg and Romania);

6) A panel with 290 observations for the same 10 years (1999-2008) and 29 countries (the same EU-25 plus Japan, Norway, Switzerland and the USA).

Taking into account our aim to compare the degree of integration among EU countries and some non-EU countries, we choose two benchmark countries: Germany and the USA; we use the provided series to calculate, for each of the selected countries, the differences between the country's rate and Germany's rate, as well as the difference between the country's rate and the US rate[1].

[1] Except for the individual series of these two countries, where in all situations, we must consider the differences in the other benchmark's rates. Thus, for Gerrnany, we always take account of the difference between the German rates and the US rates and vice-versa, for the USA, we always consider the difference beween the US rates and the German rates.

So, for each of the six panels, we will consider the following variables:

1. ILN = Nominal long-term interest rates
2. ILRC = Real long-term interest rates, deflator private consumption
3. ILRV = Real long-term interest rates, deflator GDP
4. ISN = Nominal short-term interest rates
5. ISRC = Real short-term interest rates, deflator private consumption
6. ISRV = Real short-term interest rates, deflator GDP
7. IYN = Yield curve
8. $\Delta ILN_{Germany} = (ILN)_i - (ILN)_{Germany}$
9. $\Delta ILRC_{Germany} = (ILRC)_i - (ILRC)_{Germany}$
10. $\Delta ILRV_{Germany} = (ILRV)_i - (ILRV)_{Germany}$
11. $\Delta ISN_{Germany} = (ISN)_i - (ISN)_{Germany}$
12. $\Delta ISRC_{Germany} = (ISRC)_i - (ISRC)_{Germany}$
13. $\Delta ISRV_{Germany} = (ISRV)_i - (ISRV)_{Germany}$
14. $\Delta IYN_{Germany} = (IYN)_i - (IYN)_{Germany}$
15. $\Delta ILN_{USA} = (ILN)_i - (ILN)_{USA}$
16. $\Delta ILRC_{USA} = (ILRC)_i - (ILRC)_{USA}$
17. $\Delta ILRV_{USA} = (ILRV)_i - (ILRV)_{USA}$
18. $\Delta ISN_{USA} = (ISN)_i - (ISN)_{USA}$
19. $\Delta ISRC_{USA} = (ISRC)_i - (ISRC)_{USA}$
20. $\Delta ISRV_{USA} = (ISRV)_i - (ISRV)_{USA}$
21. $\Delta IYN_{USA} = (IYN)_i - (IYN)_{USA}$

3. Panel Unit Root and Cointegration Tests

In the last few years, the literature and empirical estimations on panel unit root and cointegration tests has advanced considerably and has begun to distinguish between the "first" generation tests, which are mainly based on the assumption of cross-sectional independence among the panel units, except for the common time effects, and the "second" generation tests which includes tests allowing for different types of cross-sectional dependence among the panel units and tests allowing for structural breaks.

Among the available "first" generation panel unit root tests, we choose to use the Levin, Lin and Chu (2002) test and the Im, Pesaran and Shin (2003) test.

The Levin, Lin and Chu (2002) may be viewed as a pooled Dickey-Fuller test, or as an augmented Dickey-Fuller test, when lags are included and the null hypothesis is the existence of non-stationarity. This test is adequate for heterogeneous panels of moderate size, like the panels used in

this paper, with fixed-effects and it assumes that there is a common unit root process. The results reported in Appendix I allow us to reject the existence of the null hypothesis.

The Im, Pesaran and Shin (2003) test estimates the t-test for unit roots in heterogeneous panels and allows for individual unit root processes. It is based on the mean of the individual Dickey-Fuller t-statistics of each unit in the panel and assumes that all series are non-stationary under the null hypothesis. Appendix II presents the obtained results and they confirm the rejection of the non-stationarity.

Representing the "second" generation of tests, we implement four panel cointegration tests developed by Westerlund (2007) and Westerlund and Edgerton (2007), which test for the absence of cointegration by determining whether the individual panel members are error correcting. These tests are very flexible[2], working well in unbalanced, heterogeneous and/or relatively small panels and they allow for dependence both between and within the cross-panel units.

These tests provide four test statistics: Gt, Ga, Pt and Pa. The Gt and Ga statistics test H0: $a_i = 0$ for all i versus H1: $a_i < 0$ for at least one of the series, i, starting from a weighted average of the individually estimated coefficients a_i and their respective t-ratios. The Pt and Pa test statistics consider the pooled information of all panel cross-section units to test H0: $a_i = 0$ for all i versus H1: $a_i < 0$ for all cross-section units. Thus, the rejection of the H0 has always to be taken as the rejection of the cointegration for the whole panel. Any single cross-unit can cause the rejection of the H0 and it is not possible to identify which cross-unit is responsible for this rejection.

In this paper, we apply the bootstrap version of the Westerlund (2007) cointegration test to the seven rates included in our panel and their respective differences to the considered benchmarks: the German and the US rates. For each of the considered panels of countries and time periods, we report the obtained robust p-values[3].

[2] The application of these panel cointegration tests to the i series included in one panel will consider, for each moment t (during the time interval t=0,…,p), the following error-correction model:
$Dy_{it} = c_i + a_{i1}*Dy_{it-1} + \ldots + a_{ip}*Dy_{it-p} + b_{i0}*Dx_{it} + b_{i1}*x_{it-1} + \ldots + b_{ip} * Dx_{it-p} + a_i (y_{it-1} - b_i*x_{it-1}) + u_{it}$

[3] The statistic values, Z-values and non-robust p-values are also available and will be provided on request.

Table 1 - Bootstrap robust p-values obtained with the Westerlund (2007) panel cointegration test - 1961-2008

Cointegration between the variables *	EU9**				EU9+USA			
	Gt	Ga	Pt	Pa	Gt	Ga	Pt	Pa
ILN and $\Delta ILN_{Germany}$	0.480	0.350	0.360	0.240	0.490	0.320	0.390	0.220
ILRC and Δ $ILRC_{Germany}$	0.020	0.000	0.000	0.000	0.010	0.000	0.000	0.000
ILRV and Δ $ILRV_{Germany}$	0.000	0.000	0.000	0.000	0.000	0.020	0.000	0.000
ISN and Δ $ISN_{Germany}$	0.030	0.040	0.020	0.020	0.030	0.040	0.010	0.000
ISRC and Δ $ISRC_{Germany}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ISRV and Δ $ISRV_{Germany}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
IYN and Δ $IYN_{Germany}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ILN and ΔILN_{USA}	0.500	0.540	0.380	0.410	0.460	0.520	0.430	0.460
ILRC and Δ $ILRC_{USA}$	0.340	0.300	0.320	0.270	0.280	0.200	0.200	0.150
ILRV and Δ $ILRV_{USA}$	0.420	0.450	0.400	0.430	0.320	0.320	0.390	0.350
ISN and Δ ISN_{USA}	0.220	0.260	0.140	0.160	0.160	0.160	0.070	0.080
ISRC and Δ $ISRC_{USA}$	0.120	0.120	0.090	0.050	0.080	0.110	0.060	0.070
ISRV and Δ $ISRV_{USA}$	0.160	0.220	0.060	0.060	0.120	0.110	0.070	0.050
IYN and Δ IYN_{USA}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

*ILN = Nominal long-term interest rates; ILRC = Real long-term interest rates, deflator private consumption; ILRV = Real long-term interest rates, deflator GDP; ISN = Nominal short-term interest rates; ISRC = Real short-term interest rates, deflator private consumption; ISRV = Real short-term interest rates, deflator GDP; IYN = Yield curve; $\Delta ILN_{Germany} = (ILN)_i - (ILN)_{Germany}$; $\Delta ILRC_{Germany} = (ILRC)_i - (ILRC)_{Germany}$; $\Delta ILRV_{Germany} = (ILRV)_i - (ILRV)_{Germany}$; $\Delta ISN_{Germany} = (ISN)_i - (ISN)_{Germany}$; $\Delta ISRC_{Germany} = (ISRC)_i - (ISRC)_{Germany}$; $\Delta ISRV_{Germany} = (ISRV)_i - (ISRV)_{Germany}$; $\Delta IYN_{Germany} = (IYN)_i - (IYN)_{Germany}$; $\Delta ILN_{USA} = (ILN)_i - (ILN)_{USA}$; $\Delta ILRC_{USA} = (ILRC)_i - (ILRC)_{USA}$; $\Delta ILRV_{USA} = (ILRV)_i - (ILRV)_{USA}$; $\Delta ISN_{USA} = (ISN)_i - (ISN)_{USA}$; $\Delta ISRC_{USA} = (ISRC)_i - (ISRC)_{USA}$; $\Delta ISRV_{USA} = (ISRV)_i - (ISRV)_{USA}$; $\Delta IYN_{USA} = (IYN)_i - (IYN)_{USA}$.

**EU9 = Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Sweden, United Kingdom

According to the results reported in Table 1, we can conclude that the differences between the left and the right sides of the table are not relevant, meaning that the inclusion of the USA in the panel of EU-9 countries does not provide any significant changes in the approximation between the considered countries.

Reading across the lines of this table, we clearly see the differences between its first part, where almost all p-values indicate strong approximation, both between and within the cross-units and in the panel as a whole, demonstrating the approximation of the different countries' interest rates to the German patterns. The only exception is the series of the nominal long-term interest rate, which reveals the individual behaviour of the included countries and is clearly not closed to the differences to the German nominal long-term rate.

On the other hand, the lines of the second part of Table 1 evidently show that there is no approximation with the USA´s patterns. The only exception is the series of the yield curves, which always reveals integration not only with the German but also with the US yield curves.

Table 2 - Bootstrap robust p-values obtained with the Westerlund (2007) panel cointegration test - 1985-2008

Cointegration between the variables *	EU14**				EU14+Japan+Norway+USA			
	Gt	Ga	Pt	Pa	Gt	Ga	Pt	Pa
ILN and $\Delta ILN_{Germany}$	0.230	0.460	0.270	0.490	0.330	0.580	0.310	0.550
ILRC and Δ $ILRC_{Germany}$	0.270	0.440	0.100	0.220	0.240	0.570	0.080	0.240
ILRV and Δ $ILRV_{Germany}$	0.220	0.400	0.140	0.130	0.250	0.400	0.180	0.170
ISN and Δ $ISN_{Germany}$	0.000	0.230	0.000	0.080	0.000	0.280	0.010	0.110
ISRC and Δ $ISRC_{Germany}$	0.010	0.160	0.010	0.070	0.030	0.240	0.030	0.120
ISRV and Δ $ISRV_{Germany}$	0.220	0.380	0.100	0.150	0.160	0.420	0.110	0.140
IYN and Δ $IYN_{Germany}$	0.120	0.010	0.080	0.000	0.090	0.020	0.080	0.010
ILN and ΔILN_{USA}	0.900	0.940	0.890	0.930	0.850	0.910	0.870	0.920
ILRC and Δ $ILRC_{USA}$	0.690	0.950	0.690	0.800	0.750	0.910	0.660	0.800
ILRV and Δ $ILRV_{USA}$	0.950	0.980	0.880	0.960	0.900	1.000	0.850	0.910
ISN and Δ ISN_{USA}	0.780	0.830	0.730	0.740	0.820	0.880	0.810	0.760
ISRC and Δ $ISRC_{USA}$	0.420	0.780	0.270	0.590	0.410	0.820	0.230	0.400
ISRV and Δ $ISRV_{USA}$	0.650	0.810	0.440	0.660	0.570	0.810	0.420	0.520
IYN and Δ IYN_{USA}	0.230	0.070	0.040	0.020	0.250	0.040	0.090	0.020

*ILN = Nominal long-term interest rates; ILRC = Real long-term interest rates, deflator private consumption; ILRV = Real long-term interest rates, deflator GDP; ISN = Nominal short-term interest rates; ISRC = Real short-term interest rates, deflator private consumption; ISRV = Real short-term interest rates, deflator GDP; IYN = Yield curve; $\Delta ILN_{Germany} = (ILN)_i - (ILN)_{Germany}$; $\Delta ILRC_{Germany} = (ILRC)_i - (ILRC)_{Germany}$; $\Delta ILRV_{Germany} = (ILRV)_i - (ILRV)_{Germany}$; $\Delta ISN_{Germany} = (ISN)_i - (ISN)_{Germany}$; $\Delta ISRC_{Germany} = (ISRC)_i - (ISRC)_{Germany}$; $\Delta ISRV_{Germany} = (ISRV)_i - (ISRV)_{Germany}$; $\Delta IYN_{Germany} = (IYN)_i - (IYN)_{Germany}$; $\Delta ILN_{USA} = (ILN)_i - (ILN)_{USA}$; $\Delta ILRC_{USA} = (ILRC)_i - (ILRC)_{USA}$; $\Delta ILRV_{USA} = (ILRV)_i - (ILRV)_{USA}$; $\Delta ISN_{USA} = (ISN)_i - (ISN)_{USA}$; $\Delta ISRC_{USA} = (ISRC)_i - (ISRC)_{USA}$; $\Delta ISRV_{USA} = (ISRV)_i - (ISRV)_{USA}$; $\Delta IYN_{USA} = (IYN)_i - (IYN)_{USA}$.

**EU14 = Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, United Kingdom.

Table 2 presents the bootstrap robust p-values obtained for the two panels during the time period 1985-2008, that is, after the implementation of the Single Market Program and the beginning of the relevant EU enlargement processes. The 14 EU countries included in our panels are more heterogeneous, as are the non-EU countries that we consider in the right column of the table, and the results reveal their individualities. The differences between the two groups of countries are now more evident and they indicate the greater heterogeneity of the panel when 3 non-EU countries were added.

Generally speaking, and with very few exceptions, there are no clear cointegration relationships in either panel. However, reading carefully across the lines, we still find some differences between the first and the second parts of the table, revealing that the approximation to the German patterns is still stronger that the approximation to those of the USA.

The few exceptions of approximation in the series behaviour are to be found in the short-time nominal interest rate and, to a lesser extent, also in the real short-term interest rate (using the private consumption deflator) which approximate to the German rates. This may be understood as a symptom of the required monetary integration in the context of the EMU implementation process. The yield curves also reveal their particular behaviour and are still much more correlated than the other series.

Table 3 - Bootstrap robust p-values obtained with the Westerlund (2007) panel cointegration test - 1999-2008

Cointegration between the variables *	EU25**				EU25 + + Japan+Norway+Switzerland+USA			
	Gt	Ga	Pt	Pa	Gt	Ga	Pt	Pa
ILN and $\Delta ILN_{Germany}$	0.000	0.760	0.040	0.610	0.000	0.730	0.060	0.680
ILRC and Δ $ILRC_{Germany}$	0.000	0.740	0.180	0.800	0.000	0.860	0.220	0.930
ILRV and Δ $ILRV_{Germany}$	0.000	0.780	0.030	0.560	0.000	0.780	0.080	0.490
ISN and Δ $ISN_{Germany}$	0.000	0.260	0.040	0.030	0.000	0.260	0.020	0.010
ISRC and Δ $ISRC_{Germany}$	0.000	0.550	0.020	0.310	0.000	0.630	0.010	0.450
ISRV and Δ $ISRV_{Germany}$	0.000	0.150	0.020	0.090	0.000	0.140	0.060	0.070
IYN and Δ $IYN_{Germany}$	0.000	0.840	0.190	0.450	0.000	0.720	0.280	0.440
ILN and ΔILN_{USA}	0.000	0.740	0.090	0.630	0.000	0.820	0.020	0.600
ILRC and Δ $ILRC_{USA}$	0.000	0.480	0.150	0.470	0.000	0.320	0.170	0.460
ILRV and Δ $ILRV_{USA}$	0.000	0.560	0.000	0.650	0.000	0.550	0.000	0.650
ISN and Δ ISN_{USA}	0.000	0.470	0.020	0.250	0.000	0.430	0.000	0.190
ISRC and Δ $ISRC_{USA}$	0.000	0.150	0.010	0.060	0.000	0.190	0.030	0.130
ISRV and Δ $ISRV_{USA}$	0.000	0.150	0.010	0.120	0.000	0.120	0.000	0.230
IYN and Δ IYN_{USA}	0.000	0.620	0.480	0.570	0.000	0.580	0.520	0.530

*ILN = Nominal long-term interest rates; ILRC = Real long-term interest rates, deflator private consumption; ILRV = Real long-term interest rates, deflator GDP; ISN = Nominal short-term interest rates; ISRC = Real short-term interest rates, deflator private consumption; ISRV = Real short-term interest rates, deflator GDP; IYN = Yield curve; $\Delta ILN_{Germany} = (ILN)_i - (ILN)_{Germany}$; $\Delta ILRC_{Germany} = (ILRC)_i - (ILRC)_{Germany}$; $\Delta ILRV_{Germany} = (ILRV)_i - (ILRV)_{Germany}$; $\Delta ISN_{Germany} = (ISN)_i - (ISN)_{Germany}$; $\Delta ISRC_{Germany} = (ISRC)_i - (ISRC)_{Germany}$; $\Delta ISRV_{Germany} = (ISRV)_i - (ISRV)_{Germany}$; $\Delta IYN_{Germany} = (IYN)_i - (IYN)_{Germany}$; $\Delta ILN_{USA} = (ILN)_i - (ILN)_{USA}$; $\Delta ILRC_{USA} = (ILRC)_i - (ILRC)_{USA}$; $\Delta ILRV_{USA} = (ILRV)_i - (ILRV)_{USA}$; $\Delta ISN_{USA} = (ISN)_i - (ISN)_{USA}$; $\Delta ISRC_{USA} = (ISRC)_i - (ISRC)_{USA}$; $\Delta ISRV_{USA} = (ISRV)_i - (ISRV)_{USA}$; $\Delta IYN_{USA} = (IYN)_i - (IYN)_{USA}$.

**EU-25 = all the actual EU members except Luxembourg and Romania.

The robust p-values obtained for the last two panels (one with EU-25 countries and the other with 4 non-EU countries included, both for the time period 1999-2008) are reported in Table 3 and they clearly show the differences among the four test statistics provided by the Westerlund (2007) panel cointegration tests.

Now for both panels, the Gt columns indicate clear integration between the countries' rates, revealing the importance of the approximation of the rates, for at least some countries in the context of monetary integration.

However, as expected in a dynamic world and with panels of quite heterogeneous countries, the Ga and Pa p-values clearly point to non-integration, not only within at least one country, but also overall for the pooled information of both panels.

4. Fixed-effects estimates and cross-sectional independence

In order to continue our analysis of the degree of integration between the considered countries' rates and the two chosen benchmarks, we will apply panel fixed-effects estimates to the general regression model represented by equation [1]

After each regression, we test the hypothesis of cross-sectional independence using the test proposed in Pesaran (2004), which follows a standard normal distribution and is able to deal with balanced and unbalanced panels. Here, we present not only the Pesaran statistic, but also the average value of the off-diagonal elements of the cross-sectional correlation matrix of residuals.

Table 4 reports, for our first two panels of countries (EU-9 and EU-9 plus USA, both for the time period 1961-2008), the fixed-effects coefficients, t-statistics, p-values, the respective between and overall R-squared values, as well as the Pesaran test results for all considered nominal and real interest rates and the yield curves[4].

The presented results confirm the better approximation of almost all considered rates to the German rates than to the US rates. In addition, since the reported overall R-squared values are always a little higher than the within R-squares, they also allow us to conclude that the approximation is mainly between the different countries, our cross-units, for the same time periods, rather than the approximation within each individual country during this relatively long time interval.

The reported Pesaran results are in line with the previous conclusions.

They are always higher, revealing more independent relationships, when the explaining variable is the difference between the country's rate and the US rate.

Moreover, they confirm that in these two panels, the highest degree of integration is among the yield curves, which, nevertheless, also reveal their specific characteristics. Now it becomes very clear that the yield does not depend mostly on the approximation to the German patterns, rather

[4] Here we do not report the obtained results for the independent coefficients, α, but they are available on request.

they reflect the dynamic character of the international financial markets, in which the USA still has a dominant role.

Table 4 – Fixed-effects panel estimates and Pesaran (2004) test of cross-sectional independence - 1961-2008

Variables *		**EU9 ****		**EU9+USA**	
		$\Delta_{Germany}$	Δ_{USA}	$\Delta_{Germany}$	Δ_{USA}
Dependent variable: **ILN**					
Coef.		1.143	1.120	1.123	1.094
t-stat.		30.58	18.16	31.21	19.19
P >| t |		0.000	0.000	0.000	0.000
R-squared:	within	0.6890	0.4386	0.6750	0.4399
	overall	0.7150	0.4875	0.7057	0.4945
Pesaran´s test ***		**35.679**	**41.418**	**40.904**	**41.564**
		(0.858)	**(0.996)**	**(0.880)**	**(0.894)**
Dependent variable: **ILRC**					
Coef.		0.983	0.791	0.985	0.808
t-stat.		32.25	15.21	33.59	16.66
P >| t |		0.000	0.000	0.000	0.000
R-squared:	within	0.7114	0.3540	0.7064	0.3718
	overall	0.7225	0.4003	0.7171	0.4076
Pesaran´s test ***		**38.236**	**40.647**	**43.106**	**44.000**
		(0.920)	**(0.978)**	**(0.927)**	**(0.947)**
Dependent variable: **ILRV**					
Coef.		0.924	0.838	0.926	0.848
t-stat.		34.04	16.45	35.31	17.90
P >| t |		0.000	0.000	0.000	0.000
R-squared:	within	0.7330	0.3906	0.7266	0.4058
	overall	0.7441	0.4272	0.7373	0.4345
Pesaran´s test ***		**38.089**	**40.860**	**42.965**	**43.341**
		(0.916)	**(0.983)**	**(0.924)**	**(0.933)**
Dependent variable: **ISN**					
Coef.		0.938	0.936	0.912	0.908
t-stat.		21.41	19.26	21.66	19.60
P >| t |		0.000	0.000	0.000	0.000
R-squared:	within	0.5206	0.4678	0.5001	0.4504
	overall	0.5833	0.5376	0.5695	0.5257
Pesaran´s test ***		**38.405**	**41.495**	**43.455**	**43.480**
		(0.924)	**(0.998)**	**(0.935)**	**(0.936)**
Dependent variable: **ISRC**					
Coef.		0.991	0.837	0.975	0.832
t-stat.		28.43	21.29	28.97	22.18
P >| t |		0.000	0.000	0.000	0.000
R-squared:	within	0.6570	0.5180	0.6415	0.5119
	overall	0.6690	0.5400	0.6543	0.5314
Pesaran´s test ***		**37.486**	**40.780**	**42.490**	**43.357**
		(0.902)	**(0.981)**	**(0.914)**	**(0.933)**
Dependent var: **$ISRV_i$**					
Coef.		0.900	0.862	0.888	0.852
t-stat.		27.29	21.89	27.74	22.58
P >| t |		0.000	0.000	0.000	0.000
R-squared:	within	0.6383	0.5318	0.6214	0.5209
	overall	0.6569	0.5578	0.6403	0.5452
Pesaran´s test ***		**38.105**	**40.896**	**42.976**	**43.105**
		(0.917)	**(0.984)**	**(0.925)**	**(0.927)**

Dependent variable: **IYN**				
Coef.	0.500	0.607	0.486	0.586
t-stat.	13.70	22.28	14.19	22.17
P >| t |	0.000	0.000	0.000	0.000
R-squared: within	0.3077	0.5404	0.3005	0.5117
overall	0.3632	0.5772	0.3517	0.5456
Pesaran´s test ***	**30.883**	**31.995**	**33.985**	**34.458**
	(0.743)	**(0.769)**	**(0.731)**	**(0.741)**

*ILN = Nominal long-term interest rates; ILRC = Real long-term interest rates, deflator private consumption; ILRV = Real long-term interest rates, deflator GDP; ISN = Nominal short-term interest rates; ISRC = Real short-term interest rates, deflator private consumption; ISRV = Real short-term interest rates, deflator GDP; IYN = Yield curve; $\Delta ILN_{Germany} = (ILN)_i - (ILN)_{Germany}$; $\Delta ILRC_{Germany} = (ILRC)_i - (ILRC)_{Germany}$; $\Delta ILRV_{Germany} = (ILRV)_i - (ILRV)_{Germany}$; $\Delta ISN_{Germany} = (ISN)_i - (ISN)_{Germany}$; $\Delta ISRC_{Germany} = (ISRC)_i - (ISRC)_{Germany}$; $\Delta ISRV_{Germany} = (ISRV)_i - (ISRV)_{Germany}$; $\Delta IYN_{Germany} = (IYN)_i - (IYN)_{Germany}$; $\Delta ILN_{USA} = (ILN)_i - (ILN)_{USA}$; $\Delta ILRC_{USA} = (ILRC)_i - (ILRC)_{USA}$; $\Delta ILRV_{USA} = (ILRV)_i - (ILRV)_{USA}$; $\Delta ISN_{USA} = (ISN)_i - (ISN)_{USA}$; $\Delta ISRC_{USA} = (ISRC)_i - (ISRC)_{USA}$; $\Delta ISRV_{USA} = (ISRV)_i - (ISRV)_{USA}$; $\Delta IYN_{USA} = (IYN)_i - (IYN)_{USA}$.

**EU9 = Belgium, Denmark, Finland France, Germany, Italy, Netherlands, Sweden, United Kingdom.

*** Pesaran´s statistic and, in brackets, the average value of the off-diagonal elements of the cross-sectional correlation matrix of residuals.

The obtained results for our EU-14 and EU-14 plus three non-EU countries for the time period 1985-2008 are presented in Table 5. They confirm the relatively highest independency, since the panels now include more heterogeneous countries.

The differences between these two panels are now a little clearer: the Pesaran results for the series of the second panel, including 14 EU countries plus Japan, Norway and the USA, are almost always higher, revealing the comparatively strongest degree of integration among the EU countries.

On the other hand, and in line with our previous results, in both panels, the approximation of the different countries' rates to the German rates is always more relevant than the approximation to the USA's rates. Furthermore, now and particularly for the panel of the EU-14 countries, not only the series of the nominal long-term interest rates but also the series of the nominal short-term interest rates show a high degree of dependency and approximation of the EU rates towards the German rates, as required for the implementation of the single monetary policy.

The results obtained for the series of the yield curves go on showing their specific characteristics: they are highly integrated but not exactly in approximation to the German yield curve.

Table 5 – Fixed-effects panel estimates and Pesaran (2004) test of cross-sectional independence - 1985-2008

Variables *		**EU14****		**EU14+Japan+Norway+USA**	
		$\Delta_{Germany}$	Δ_{USA}	$\Delta_{Germany}$	Δ_{USA}
Dependent variable: **ILN**					
Coef.		1.266	1.323	1.231	1.244
t-stat.		45.70	34.84	46.26	34.96
P >| t |		0.000	0.000	0.000	0.000
R-squared:	within	0.8668	0.7908	0.8458	0.7581
	overall	0.8804	0.8219	0.8723	0.8079
Pesaran´s test ***		**35.546**	**39.583**	**46.906**	**50.148**
		(0.773)	**(0.847)**	**(0.825)**	**(0.879)**
Dependent variable: **ILRC**					
Coef.		1.042	0.976	0.990	0.915
t-stat.		20.39	17.21	20.36	17.17
P >| t |		0.000	0.000	0.000	0.000
R-squared:	within	0.5642	0.4799	0.5153	0.4305
	overall	0.5808	0.5024	0.5435	0.4639
Pesaran´s test ***		**45.323**	**46.719**	**55.938**	**56.006**
		(0.970)	**(1.000)**	**(0.979)**	**(0.980)**
Dependent variable: **ILRV**					
Coef.		0.961	0.871	0.940	0.892
t-stat.		29.16	15.66	34.87	19.82
P >| t |		0.000	0.000	0.000	0.000
R-squared:	within	0.7259	0.4332	0.7572	0.5018
	overall	0.7438	0.4702	0.7709	0.5301
Pesaran´s test ***		**44.448**	**46.274**	**54.721**	**54.750**
		(0.951)	**(0.990)**	**(0.958)**	**(0.958)**
Dependent variable: **ISN**					
Coef.		1.209	1.014	1.160	0.994
t-stat.		31.48	28.34	31.81	29.39
P >| t |		0.000	0.000	0.000	0.000
R-squared:	within	0.7554	0.7145	0.7218	0.6890
	overall	0.7951	0.7706	0.7824	0.7620
Pesaran´s test ***		**38.532**	**46.727**	**50.054**	**52.894**
		(0.829)	**(1.000)**	**(0.876)**	**(0.926)**
Dependent variable: **ISRC**					
Coef.		1.134	0.789	1.103	0.765
t-stat.		27.33	21.02	28.01	22.12
P >| t |		0.000	0.000	0.000	0.000
R-squared:	within	0.6993	0.5792	0.6679	0.5565
	overall	0.7130	0.6006	0.6928	0.5894
Pesaran´s test ***		**41.549**	**45.477**	**52.25**	**54.126**
		(0.889)	**(0.973)**	**(0.915)**	**(0.947)**
Dependent var: **$ISRV_i$**					
Coef.		1.031	0.768	1.002	0.786
t-stat.		33.48	19.88	38.71	23.77
P >| t |		0.000	0.000	0.000	0.000
R-squared:	within	0.7774	0.5519	0.7934	0.5917
	overall	0.7911	0.5781	0.8069	0.6168
Pesaran´s test ***		**42.454**	**45.046**	**53.082**	**53.250**
		(0.908)	**(0.964)**	**(0.929)**	**(0.932)**
Dependent variable: **IYN**					
Coef.		0.706	0.565	0.653	0.340
t-stat.		13.44	19.74	14.42	8.47
P >| t |		0.000	0.000	0.000	0.000

R-squared:	within	0.3601	0.5483	0.3478	0.5371
	overall	0.4158	0.5761	0.4052	0.5675
Pesaran´s test ***		**39.655**	**38.122**	**48.334**	**45.950**
		(0.849)	**(0.816)**	**(0.846)**	**(0.804)**

*ILN = Nominal long-term interest rates; ILRC = Real long-term interest rates, deflator private consumption; ILRV = Real long-term interest rates, deflator GDP; ISN = Nominal short-term interest rates; ISRC = Real short-term interest rates, deflator private consumption; ISRV = Real short-term interest rates, deflator GDP; IYN = Yield curve; $\Delta ILN_{Germany} = (ILN)_i - (ILN)_{Germany}$; $\Delta ILRC_{Germany} = (ILRC)_i - (ILRC)_{Germany}$; $\Delta ILRV_{Germany} = (ILRV)_i - (ILRV)_{Germany}$; $\Delta ISN_{Germany} = (ISN)_i - (ISN)_{Germany}$; $\Delta ISRC_{Germany} = (ISRC)_i - (ISRC)_{Germany}$; $\Delta ISRV_{Germany} = (ISRV)_i - (ISRV)_{Germany}$; $\Delta IYN_{Germany} = (IYN)_i - (IYN)_{Germany}$; $\Delta ILN_{USA} = (ILN)_i - (ILN)_{USA}$; $\Delta ILRC_{USA} = (ILRC)_i - (ILRC)_{USA}$; $\Delta ILRV_{USA} = (ILRV)_i - (ILRV)_{USA}$; $\Delta ISN_{USA} = (ISN)_i - (ISN)_{USA}$; $\Delta ISRC_{USA} = (ISRC)_i - (ISRC)_{USA}$; $\Delta ISRV_{USA} = (ISRV)_i - (ISRV)_{USA}$; $\Delta IYN_{USA} = (IYN)_i - (IYN)_{USA}$.

**EU-14 = Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, United Kingdom.

*** Pesaran´s statistic and, in brackets, the average value of the off-diagonal elements of the cross-sectional correlation matrix of residuals.

According to the results reported in Table 6 for our last two panels (one with 25 EU countries and the other for this EU-25 plus four other non-EU countries, both panels for the time period 1999-2008), and as expected, the enlargement process to much more heterogeneous countries decreased the degree of integration between the series and the countries included in our panels.

Nevertheless, there is still a clear approximation of all series of the different interest rates to the German rates, and particularly with regard to the values of the nominal short-term interest rate, which may be taken as a proxy for the monetary policy rates.

In addition, confirming the previous conclusions obtained with the Westerlund (2007) panel cointegration tests for these two panels, in Table 6 we also observe that the within R-squares are always lower than the overall ones, revealing that, after the implementation of the EMU, the approximation overall the different countries' series of rates is stronger than the evolution within each of the considered national series.

The specific characteristics of this time period in the aftermath of the implementation of the single currency explain the changes in the results obtained for the yield curves. Now for the overall panels, the approximation to the German patterns acquire relevance, revealing not only the much easier circulation among EU countries, but particularly the role of the single monetary policy and the influence of the historically low interest rates in capital markets in EMU, EU and even non-EU countries.

Table 6 – Fixed-effects panel estimates and Pesaran (2004) test of cross-sectional independence - 1999-2008

Variables *		**EU25****		**EU25+ +Japan+Norway+Switzerland+USA**	
		$\Delta_{Germany}$	Δ_{USA}	$\Delta_{Germany}$	Δ_{USA}
Dependent variable: **ILN**					
	Coef.	1.079	0.899	1.045	0.861
	t-stat.	22.87	18.58	22.98	18.58
	P >| t |	0.000	0.000	0.000	0.000
R-squared:	within	0.7002	0.6064	0.6701	0.5705
	overall	0.8273	0.7824	0.8533	0.8103
Pesaran´s test ***		**50.185**	**54.425**	**59.501**	**62.283**
		(0.916)	**(0.994)**	**(0.934)**	**(0.977)**
Dependent variable: **ILRC**					
	Coef.	0.979	0.909	0.960	0.871
	t-stat.	27.46	19.43	27.48	19.37
	P >| t |	0.000	0.000	0.000	0.000
R-squared:	within	0.7710	0.6276	0.7439	0.5908
	overall	0.8185	0.7119	0.8008	0.6836
Pesaran´s test ***		**53.173**	**54.329**	**62.032**	**62.585**
		(0.971)	**(0.992)**	**(0.974)**	**(0.982)**
Dependent variable: **ILRV**					
	Coef.	0.878	0.914	0.857	0.890
	t-stat.	25.58	25.25	28.53	27.91
	P >| t |	0.000	0.000	0.000	0.000
R-squared:	within	0.7450	0.7401	0.7579	0.7498
	overall	0.7956	0.7989	0.8006	0.7931
Pesaran´s test ***		**50.837**	**54.089**	**58.261**	**61.321**
		(0.928)	**(0.988)**	**(0.914)**	**(0.962)**
Dependent variable: **ISN**					
	Coef.	0.936	0.572	0.922	0.550
	t-stat.	24.91	11.75	25.80	12.18
	P >| t |	0.000	0.000	0.000	0.000
R-squared:	within	0.7348	0.3812	0.7192	0.3634
	overall	0.8529	0.6132	0.8603	0.6326
Pesaran´s test ***		**48.419**	**49.292**	**57.148**	**56.807**
		(0.884)	**(0.900)**	**(0.897)**	**(0.892)**
Dependent variable: **ISRC**					
	Coef.	0.910	0.590	0.906	0.566
	t-stat.	28.20	12.39	28.96	12.69
	P >| t |	0.000	0.000	0.000	0.000
R-squared:	within	0.7802	0.4065	0.7634	0.3823
	overall	0.8421	0.5491	0.8312	0.5285
Pesaran´s test ***		**50.642**	**47.252**	**59.381**	**54.531**
		(0.925)	**(0.863)**	**(0.932)**	**(0.856)**
Dependent var: $\mathbf{ISRV_i}$					
	Coef.	0.868	0.690	0.859	0.664
	t-stat.	25.25	14.53	27.97	16.63
	P >| t |	0.000	0.000	0.000	0.000
R-squared:	within	0.7400	0.4853	0.7506	0.5155
	overall	0.8108	0.6175	0.8104	0.6206
Pesaran´s test ***		**49.261**	**47.678**	**56.931**	**54.329**
		(0.899)	**(0.874)**	**(0.893)**	**(0.853)**

Dependent variable: **IYN**				
Coef.	0.756	0.356	0.733	0.351
t-stat.	14.82	7.46	15.74	8.07
P >| t |	0.000	0.000	0.000	0.000
R-squared: within	0.4951	0.1990	0.4878	0.2002
overall	0.7060	0.4332	0.6915	0.4204
Pesaran´s test ***	**48.591**	**40.358**	**56.090**	**46.387**
	(0.887	**(0.746)**	**(0.880)**	**(0.736)**

*ILN = Nominal long-term interest rates; ILRC = Real long-term interest rates, deflator private consumption; ILRV = Real long-term interest rates, deflator GDP; ISN = Nominal short-term interest rates; ISRC = Real short-term interest rates, deflator private consumption; ISRV = Real short-term interest rates, deflator GDP; IYN = Yield curve; $\Delta ILN_{Germany} = (ILN)_i - (ILN)_{Germany}$; $\Delta ILRC_{Germany} = (ILRC)_i - (ILRC)_{Germany}$; $\Delta ILRV_{Germany} = (ILRV)_i - (ILRV)_{Germany}$; $\Delta ISN_{Germany} = (ISN)_i - (ISN)_{Germany}$; $\Delta ISRC_{Germany} = (ISRC)_i - (ISRC)_{Germany}$; $\Delta ISRV_{Germany} = (ISRV)_i - (ISRV)_{Germany}$; $\Delta IYN_{Germany} = (IYN)_i - (IYN)_{Germany}$; $\Delta ILN_{USA} = (ILN)_i - (ILN)_{USA}$; $\Delta ILRC_{USA} = (ILRC)_i - (ILRC)_{USA}$; $\Delta ILRV_{USA} = (ILRV)_i - (ILRV)_{USA}$; $\Delta ISN_{USA} = (ISN)_i - (ISN)_{USA}$; $\Delta ISRC_{USA} = (ISRC)_i - (ISRC)_{USA}$; $\Delta ISRV_{USA} = (ISRV)_i - (ISRV)_{USA}$; $\Delta IYN_{USA} = (IYN)_i - (IYN)_{USA}$.

**EU-25 = all the actual EU members except Luxembourg and Romania.

*** Pesaran´s statistic and, in brackets, the average value of the off-diagonals elements of the cross-sectional correlation matrix of residuals.

5. Three-stage panel estimations for systems of simultaneous equations

Finally, we apply three-stage estimations to the system of equations represented by the general expression of equation [1], testing the approximation of our series of nominal and real rates as well as the yield curves to the German and US series. This type of estimation allows the use of some endogenous variables among the explanatory variables. In the next tables we will present for each equation of all panels the obtained coefficients, z-statistics and p-values, as well as the R-squared values of the explaining variables[5].

These results are in line with those that we obtained with fixed-effects estimates. The p-values are equal and the R-squared values are very similar and, although the values of the coefficients and p or z statistics are not the same, they always respect the same orientation or sort order and will allow the same type of conclusion.

[5] The results for the respective independent coefficients, α, will be provided on request.

Table 7 – Three-stage panel estimations - 1961-2008

Variables *	EU9 **		EU9+USA	
	$\Delta_{Germany}$	Δ_{USA}	$\Delta_{Germany}$	Δ_{USA}
Dependent variable: **ILN**				
Coef.	0.992	1.003	0.985	0.990
z-stat.	75.00	88.06	78.43	90.55
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.7058**	**0.4841**	**0.6978**	**0.4915**
Dependent variable: **ILRC**				
Coef.	0.960	0.952	0.958	0.944
t-stat.	90.70	135.5	93.06	137.3
P >| t |	0.000	0.000	0.000	0.000
R-squared:	**0.7225**	**0.3895**	**0.7171**	**0.3970**
Dependent variable: **ILRV**				
Coef.	0.960	0.962	0.954	0.954
z-stat.	107.5	141.1	108.8	142.7
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.7425**	**0.4206**	**0.7361**	**0.4283**
Dependent variable: **ISN**				
Coef.	0.979	0.983	0.970	0.975
z-stat.	84.00	104.7	86.86	106.4
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.5824**	**0.5370**	**0.5682**	**0.5246**
Dependent variable: **ISRC**				
Coef.	0.963	0.950	0.954	0.943
z-stat.	92.54	136.5	95.27	137.5
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.6688**	**0.5321**	**0.6542**	**0.5223**
Dependent variable: **ISRV**				
Coef.	0.955	0.961	0.948	0.953
z-stat.	109.4	142.9	110.7	143.6
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.6547**	**0.5521**	**0.6379**	**0.5386**
Dependent variable: **IYN**				
Coef.	0.882	0.891	0.868	0.880
z-stat.	54.10	78.00	54.63	77.73
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.2262**	**0.4875**	**0.2077**	**0.4446**

*ILN = Nominal long-term interest rates; ILRC = Real long-term interest rates, deflator private consumption; ILRV = Real long-term interest rates, deflator GDP; ISN = Nominal short-term interest rates; ISRC = Real short-term interest rates, deflator private consumption; ISRV = Real short-term interest rates, deflator GDP; IYN = Yield curve; $\Delta ILN_{Germany} = (ILN)_i - (ILN)_{Germany}$; $\Delta ILRC_{Germany} = (ILRC)_i - (ILRC)_{Germany}$; $\Delta ILRV_{Germany} = (ILRV)_i - (ILRV)_{Germany}$; $\Delta ISN_{Germany} = (ISN)_i - (ISN)_{Germany}$; $\Delta ISRC_{Germany} = (ISRC)_i - (ISRC)_{Germany}$; $\Delta ISRV_{Germany} = (ISRV)_i - (ISRV)_{Germany}$; $\Delta IYN_{Germany} = (IYN)_i - (IYN)_{Germany}$; $\Delta ILN_{USA} = (ILN)_i - (ILN)_{USA}$; $\Delta ILRC_{USA} = (ILRC)_i - (ILRC)_{USA}$; $\Delta ILRV_{USA} = (ILRV)_i - (ILRV)_{USA}$; $\Delta ISN_{USA} = (ISN)_i - (ISN)_{USA}$; $\Delta ISRC_{USA} = (ISRC)_i - (ISRC)_{USA}$; $\Delta ISRV_{USA} = (ISRV)_i - (ISRV)_{USA}$; $\Delta IYN_{USA} = (IYN)_i - (IYN)_{USA}$.

**EU-9 = Belgium, Denmark, Finland France, Germany, Italy, Netherlands, Sweden, United Kingdom.

Starting with Table 7, which reports the results obtained for our two first panels during the time interval of 48 years, we confirm that in all situations the approximation of the countries' rates to the German interest rates is more relevant than the approximation to the US rates.

Furthermore, the results for the long-term rates are still better than those for the short-term rates, demonstrating again the structural and real similarities among these nine EU countries, which are relatively homogeneous.

The quite low results for the short-term interest rates, which we may accept as a proxy for the monetary policy interest rates, reveal the influence of the individual evolution of the short-term policies, which were not entirely coordinated during the considered time interval (1961-2008). The yield curves also reveal their specific characteristics and the results obtained with three-stage panel estimates confirm the relatively low approximation of the series of the countries' yield curves to those of Germany.

Table 8 shows the results for the time period 1985-2008 and the two panels, one with 14 EU countries and the other including three non-EU countries. The comparison with the results reported in the previous table highlights the increasing importance of the approximation mainly of the nominal long-term and short-term interest rates series, but to some extent also of the yield curves to the German patterns, as a consequence of the EMU and the single monetary policy.

A more attentive observation of the series of real interest rates also reveals that those using the GDP deflator follow the German values more closely than those using the private consumption deflator, particularly in the long term. This may be accepted as another symptom of the increasing influence of the German patterns and not only on the interest rate series, but also and more clearly on the GDP deflator patterns.

Table 8 – Three-stage panel estimations - 1985-2008

Variables *	**EU14****		**EU14+Japan+Norway+USA**	
	$\Delta_{Germany}$	Δ_{USA}	$\Delta_{Germany}$	Δ_{USA}
Dependent variable: **ILN**				
Coef.	0.972	1.005	0.968	0.985
z-stat.	81.38	71.23	106.0	92.79
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.8571**	**0.8000**	**0.8536**	**0.7918**
Dependent variable: **ILRC**				
Coef.	0.878	0.865	0.859	0.854
t-stat.	59.29	59.78	67.66	74.81
P >| t |	0.000	0.000	0.000	0.000
R-squared:	**0.5675**	**0.4958**	**0.5343**	**0.4616**

Dependent variable: **ILRV**				
Coef.	0.868	0.872	0.857	0.870
z-stat.	63.69	63.67	76.36	80.32
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.7366**	**0.4701**	**0.7645**	**0.5295**
Dependent variable: **ISN**				
Coef.	0.958	0.967	0.943	0.955
z-stat.	72.08	76.47	91.36	92.08
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.7763**	**0.7692**	**0.7674**	**0.7606**
Dependent variable: **ISRC**				
Coef.	0.899	0.855	0.877	0.848
z-stat.	59.67	69.89	68.19	82.56
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.6845**	**0.5979**	**0.6666**	**0.5853**
Dependent variable: **ISRV**				
Coef.	0.887	0.861	0.871	0.860
z-stat.	63.59	71.19	75.52	85.14
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.7761**	**0.5726**	**0.7932**	**0.6134**
Dependent variable: **IYN**				
Coef.	0.869	0.814	0.840	0.786
z-stat.	42.92	52.62	45.82	57.42
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.4045**	**0.4950**	**0.3886**	**0.4937**

* ILN = Nominal long-term interest rates; ILRC = Real long-term interest rates, deflator private consumption; ILRV = Real long-term interest rates, deflator GDP; ISN = Nominal short-term interest rates; ISRC = Real short-term interest rates, deflator private consumption; ISRV = Real short-term interest rates, deflator GDP; IYN = Yield curve; $\Delta ILN_{Germany} = (ILN)_i - (ILN)_{Germany}$; $\Delta ILRC_{Germany} = (ILRC)_i - (ILRC)_{Germany}$; $\Delta ILRV_{Germany} = (ILRV)_i - (ILRV)_{Germany}$; $\Delta ISN_{Germany} = (ISN)_i - (ISN)_{Germany}$; $\Delta ISRC_{Germany} = (ISRC)_i - (ISRC)_{Germany}$; $\Delta ISRV_{Germany} = (ISRV)_i - (ISRV)_{Germany}$; $\Delta IYN_{Germany} = (IYN)_i - (IYN)_{Germany}$; $\Delta ILN_{USA} = (ILN)_i - (ILN)_{USA}$; $\Delta ILRC_{USA} = (ILRC)_i - (ILRC)_{USA}$; $\Delta ILRV_{USA} = (ILRV)_i - (ILRV)_{USA}$; $\Delta ISN_{USA} = (ISN)_i - (ISN)_{USA}$; $\Delta ISRC_{USA} = (ISRC)_i - (ISRC)_{USA}$; $\Delta ISRV_{USA} = (ISRV)_i - (ISRV)_{USA}$; $\Delta IYN_{USA} = (IYN)_i - (IYN)_{USA}$.

** EU-14 = Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, United Kingdom.

Table 9 presents the results obtained with three-stage panel estimates for our last two panels, i.e., those for the time period after the implementation of the EMU (1999-2008). Taking into account the recent large-scale enlargement process, one of these panels includes 25 EU countries, while the other adds four other non-EU countries.

Now the differences in the dynamics of the approximations towards the two chosen benchmarks are much more evident. For the long-term nominal and real interest rates, the approximation of the countries' rates towards the US rates is almost as important as the approximation towards the German rates. However, for the short-term nominal and real interest rates, as well as for the yield curves, the German influence is always much more relevant.

Table 9 – Three-stage panel estimations - 1999-2008

Variables *	EU25**		EU25+ +Japan+Norway+Switzerland+USA	
	$\Delta_{Germany}$	Δ_{USA}	$\Delta_{Germany}$	Δ_{USA}
Dependent variable: **ILN**				
Coef.	0.985	0.975	0.944	0.973
z-stat.	134.2	106.2	154.2	105.5
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.8263**	**0.7819**	**0.8530**	**0.8097**
Dependent variable: **ILRC**				
Coef.	0.984	0.964	0.982	0.946
t-stat.	151.1	90.95	166.0	86.87
P >| t |	0.000	0.000	0.000	0.000
R-squared:	**0.8184**	**0.7112**	**0.8004**	**0.6822**
Dependent variable: **ILRV**				
Coef.	0.978	0.963	0.974	0.942
z-stat.	170.3	83.46	170.9	83.84
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.7873**	**0.7983**	**0.7892**	**0.7920**
Dependent variable: **ISN**				
Coef.	0.985	0.946	0.984	0.945
z-stat.	179.9	79.91	185.9	81.35
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.8526**	**0.5710**	**0.8599**	**0.5945**
Dependent variable: **ISRC**				
Coef.	0.983	0.932	0.981	0.921
z-stat.	171.1	69.08	182.7	69.78
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.8398**	**0.5710**	**0.8289**	**0.4632**
Dependent variable: **ISRV**				
Coef.	0.980	0.945	0.977	0.928
z-stat.	183.9	74.02	182.8	73.43
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.8037**	**0.4897**	**0.8020**	**0.5814**
Dependent variable: **IYN**				
Coef.	0.981	0.888	0.978	0.880
z-stat.	147.5	49.00	144.5	50.45
P >| z |	0.000	0.000	0.000	0.000
R-squared:	**0.6949**	**0.3020**	**0.6767**	**0.2776**

*ILN = Nominal long-term interest rates; ILRC = Real long-term interest rates, deflator private consumption; ILRV = Real long-term interest rates, deflator GDP; ISN = Nominal short-term interest rates; ISRC = Real short-term interest rates, deflator private consumption; ISRV = Real short-term interest rates, deflator GDP; IYN = Yield curve; $\Delta ILN_{Germany} = (ILN)_i - (ILN)_{Germany}$; $\Delta ILRC_{Germany} = (ILRC)_i - (ILRC)_{Germany}$; $\Delta ILRV_{Germany} = (ILRV)_i - (ILRV)_{Germany}$; $\Delta ISN_{Germany} = (ISN)_i - (ISN)_{Germany}$; $\Delta ISRC_{Germany} = (ISRC)_i - (ISRC)_{Germany}$; $\Delta ISRV_{Germany} = (ISRV)_i - (ISRV)_{Germany}$; $\Delta IYN_{Germany} = (IYN)_i - (IYN)_{Germany}$; $\Delta ILN_{USA} = (ILN)_i - (ILN)_{USA}$; $\Delta ILRC_{USA} = (ILRC)_i - (ILRC)_{USA}$; $\Delta ILRV_{USA} = (ILRV)_i - (ILRV)_{USA}$; $\Delta ISN_{USA} = (ISN)_i - (ISN)_{USA}$; $\Delta ISRC_{USA} = (ISRC)_i - (ISRC)_{USA}$; $\Delta ISRV_{USA} = (ISRV)_i - (ISRV)_{USA}$; $\Delta IYN_{USA} = (IYN)_i - (IYN)_{USA}$.

**EU-25 = all the actual EU members except Luxembourg and Romania.

6. Concluding remarks

This paper applies "first" and "second" generation panel unit root and cointegration tests, as well as panel fixed-effects and three-stage panel estimates, using the available AMECO series of nominal and real long-term and short-term interest rates and yield curves covering the time period between 1961 and 2008.

The results obtained for six panels of EU and some non-EU countries for three specific time intervals allow us to conclude that:

1) In our six panels there is clear evidence of financial integration and, if we consider that the approximation of the countries' rates towards the US rates and yield curves is representative of the global financial integration while the approximation towards the German rates and yield curves represents European integration, we can conclude that there is a specific process of European integration which is, for most EU countries, much more relevant than the global process of integration.

2) The patterns of this approximation vary not only with the homogeneity of the panel countries, but also with the considered time interval. More precisely, while the implementation of the Single Market Program does not seem to be relevant to the increase of the integration process, the EMU and the adoption of the single monetary policy has enhanced European financial integration between EU countries, even between those countries outside the euro area.

3) With regard to the differences in the patterns of approximation towards the benchmarks of the individual series, there is clear evidence of the particular characteristics of the yield curves: like almost all the other series, they are always stationary and cointegrated series, but the approximation is not only with the German, but also with the US yield curves. Generally speaking, the approximation towards the German rates is more evident for the long-term than for the short-term interest rates. This is particularly true for our first panels, which include quite homogeneous countries during the entire time interval (1961-2008). The differences between nominal and real interest rates also depend mainly on the homogeneity of the panel countries' economies and the degree of independency of their monetary policies.

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Appendix I - Levin, Lin and Chu (2002) (LEVINLIN) panel unit root tests

LEVINLIN - 1961-2008

Variables *	EU9 (1961-2008)			EU9+USA (1961-2008)		
	t-star	**P > t**	**obs.**	**t-star**	**P > t**	**obs.**
ILN	-0.75970	0.2237	368	-1.04387	0.1483	414
ILRC	-5.96697	0.0000	376	-6.86974	0.0000	423
ILRV	-6.13529	0.0000	376	-7.02770	0.0000	423
ISN	-4.54645	0.0000	376	-5.00324	0.0000	423
ISRC	-7.87296	0.0000	376	-8.00135	0.0000	423
ISRV	-7.26727	0.0000	376	-7.61572	0.0000	423
IYN	-8.13542	0.0000	376	-8.07926	0.0000	423
ΔILN $_{Germany}$	-0.83679	0.2014	368	-1.18102	0.1188	414
ΔILRC $_{Germany}$	-5.99035	0.0000	376	-6.88126	0.0000	423
ΔILRV $_{Germany}$	-6.03509	0.0000	376	-6.92702	0.0000	423
ΔISN $_{Germany}$	-4.43818	0.0000	376	-4.92525	0.0000	423
ΔISRC $_{Germany}$	-7.86370	0.0000	376	-8.03380	0.0000	423
ΔISRV $_{Germany}$	-7.14578	0.0000	376	-7.55561	0.0000	423
ΔIYN $_{Germany}$	-7.82897	0.0000	376	-7.85386	0.0000	423
ΔILN $_{USA}$	-0.68334	0.2472	376	-0.86324	0.1940	405
ΔILRC $_{USA}$	-3.10117	0.0010	368	-3.62936	0.0001	414
ΔILRV $_{USA}$	-3.80741	0.0001	368	-4.46746	0.0000	414
ΔISN $_{USA}$	-3.41381	0.0003	368	-4.69192	0.0000	414
ΔISRC $_{USA}$	-3.99903	0.0000	368	-4.28832	0.0000	414
ΔISRV $_{USA}$	-4.13193	0.0000	368	-4.58329	0.0000	414
ΔIYN $_{USA}$	-4.13193	0.0000	368	-5.93755	0.0000	414

LEVINLIN - 1985-2008

Variables *	EU14 (1985-2008)			EU14+Japan+Norway+USA (1985-2008)		
	t-star	**P > t**	**obs.**	**t-star**	**P > t**	**obs.**
ILN	-5.31051	0.0000	299	-6.20477	0.0000	368
ILRC	-8.13703	0.0000	299	-8.05185	0.0000	368
ILRV	-5.96812	0.0000	299	-6.42116	0.0000	368
ISN	-4.13603	0.0000	299	-4.54063	0.0000	368
ISRC	-6.81974	0.0000	299	-7.13969	0.0000	368
ISRV	-6.04203	0.0000	299	-6.87373	0.0000	368
IYN	-6.44178	0.0000	299	-6.09136	0.0000	368
ΔILN $_{Germany}$	-5.51313	0.0000	299	-6.60866	0.0000	368
ΔILRC $_{Germany}$	-8.55595	0.0000	299	-8.38709	0.0000	368
ΔILRV $_{Germany}$	-6.25407	0.0000	299	-6.58677	0.0000	368
ΔISN $_{Germany}$	-3.65590	0.0000	299	-4.21307	0.0000	368
ΔISRC $_{Germany}$	-6.97130	0.0000	299	-7.22222	0.0000	368
ΔISRV $_{Germany}$	-6.25338	0.0000	299	-6.96543	0.0000	368
ΔIYN $_{Germany}$	-6.85837	0.0000	299	-6.48704	0.0000	368
ΔILN $_{USA}$	-4.25641	0.0000	247	-2.04093	0.0000	304
ΔILRC $_{USA}$	-2.30413	0.0106	286	-2.06000	0.0197	352
ΔILRV $_{USA}$	-3.05444	0.0011	286	-3.84182	0.0001	352
ΔISN $_{USA}$	-2.98054	0.0014	273	-4.23925	0.0000	352
ΔISRC $_{USA}$	-3.28597	0.0005	286	-3.28283	0.0005	352
ΔISRV $_{USA}$	-4.02432	0.0000	286	-4.93112	0.0000	352
ΔIYN $_{USA}$	-3.39148	0.0003	286	-4.06419	0.0000	352

LEVINLIN - 1999-2008

Variables *	EU25 (1999-2008)			EU25+ +Japan+Norway+Switzerland+USA (1999-2008)		
	t-star	P > t	obs.	t-star	P > t	obs.
ILN	-6.59900	0.0000	216	-7.70370	0.0000	252
ILRC	-5.80074	0.0000	192	-4.05149	0.0000	252
ILRV	-3.14460	0.0008	216	-4.47915	0.0000	252
ISN	-21.62761	0.0000	216	-19.96764	0.0000	252
ISRC	-7.70508	0.0000	216	-9.42141	0.0000	252
ISRV	-6.28570	0.0000	216	-7.49861	0.0000	252
IYN	-8.55931	0.0000	216	-7.26688	0.0000	252
ΔILN $_{Germany}$	-5.70611	0.0000	216	-6.69823	0.0000	252
ΔILRC $_{Germany}$	-5.21726	0.0000	192	-4.34660	0.0000	252
ΔILRV $_{Germany}$	-3.52325	0.0002	216	-4.69526	0.0000	252
ΔISN $_{Germany}$	-16.56702	0.0000	216	-16.75886	0.0000	252
ΔISRC $_{Germany}$	-7.72367	0.0000	216	-9.21705	0.0000	252
ΔISRV $_{Germany}$	-8.14994	0.0000	216	-8.99967	0.0000	252
ΔIYN $_{Germany}$	-7.30959	0.0000	216	-6.53823	0.0000	252
ΔILN $_{USA}$	-11.17996	0.0000	168	-5.38730	0.0000	224
ΔILRC $_{USA}$	-34,46709	0.0000	144	-5.08081	0.0000	224
ΔILRV $_{USA}$	-8.47538	0.0000	144	-12.10523	0.0000	224
ΔISN $_{USA}$	-6.78116	0.0000	144	-5.09249	0.0000	196
ΔISRC $_{USA}$	-7.15322	0.0000	144	-14.55328	0.0000	168
ΔISRV $_{USA}$	-29.01531	0.0000	144	-10.10851	0.0000	224
ΔIYN $_{USA}$	-10.97404	0.0000	192	-9.58694	0.0000	224

Appendix II - Im, Pesaran and Shin (2003) (IPSHIN) panel unit root tests

IPSHIN - 1961-2008

Variables *	EU9 (1961-2008)			EU9+USA (1961-2008)		
	W[t-bar]	P-value	obs.	W[t-bar]	P-value	obs.
ILN	-1.215	0.112	368	-1.525	0.064	405
ILRC	-6.298	0.000	376	-7.204	0.000	423
ILRV	-6.589	0.000	376	-7.608	0.000	423
ISN	-4.450	0.000	376	-4.944	0.000	423
ISRC	-7.821	0.000	376	-7.851	0.000	423
ISRV	-7.247	0.000	376	-7.625	0.000	423
IYN	-7.861	0.000	376	-7.792	0.000	423
ΔILN $_{Germany}$	-1.115	0.132	368	-1.500	0.067	405
ΔILRC $_{Germany}$	-6.269	0.000	376	-7.133	0.000	423
ΔILRV $_{Germany}$	-6.481	0.000	376	-7.475	0.000	423
ΔISN $_{Germany}$	-4.203	0.000	376	-4.728	0.000	423
ΔISRC $_{Germany}$	-7.859	0.000	376	-7.912	0.000	423
ΔISRV $_{Germany}$	-7.158	0.000	376	-7.573	0.000	423
ΔIYN $_{Germany}$	-7.498	0.000	376	-7.511	0.000	423
ΔILN $_{USA}$	-1.170	0.121	360	-1.472	0.071	414
ΔILRC $_{USA}$	-3.924	0.000	368	-4.543	0.000	414
ΔILRV $_{USA}$	-4.809	0.000	368	-5.669	0.000	414
ΔISN $_{USA}$	-3.583	0.000	368	-4.938	0.000	414
ΔISRC $_{USA}$	-4.601	0.000	368	-4.808	0.000	414
ΔISRV $_{USA}$	-4.792	0.000	368	-5.278	0.000	414
ΔIYN $_{USA}$	-6.015	0.000	368	-6.210	0.000	414

IPSHIN - 1985-2008

Variables *	EU14 (1985-2008)			EU14+Japan+Norway+USA (1985-2008)		
	W[t-bar]	P-value	obs.	W[t-bar]	P-value	obs.
ILN	-3.361	0.000	247	-6.678	0.000	368
ILRC	-7.711	0.000	299	-7.651	0.000	368
ILRV	-5.761	0.000	299	-6.238	0.000	368
ISN	-1.697	0.045	286	-3.190	0.001	368
ISRC	-6.135	0.000	299	-6.504	0.000	368
ISRV	-5.679	0.000	299	-6.383	0.000	368
IYN	-6.057	0.000	299	-5.609	0.000	368
$\Delta ILN_{Germany}$	-3.886	0.000	299	-7.044	0.000	368
$\Delta ILRC_{Germany}$	-7.973	0.000	299	-7.945	0.000	368
$\Delta ILRV_{Germany}$	-5.879	0.000	299	-6.310	0.000	368
$\Delta ISN_{Germany}$	-2.619	0.004	299	-3.044	0.001	368
$\Delta ISRC_{Germany}$	-6.251	0.000	299	-6.661	0.000	368
$\Delta ISRV_{Germany}$	-5.745	0.000	299	-6.398	0.000	368
$\Delta IYN_{Germany}$	-6.628	0.000	299	-6.055	0.000	368
ΔILN_{USA}	-3.861	0.000	247	-1.746	0.040	304
$\Delta ILRC_{USA}$	-7.711	0.000	299	-2.698	0.003	352
$\Delta ILRV_{USA}$	-3.482	0.000	286	-4.263	0.000	352
ΔISN_{USA}	-1.697	0.045	286	-2.949	0.001	352
$\Delta ISRC_{USA}$	-3.211	0.001	286	-3.254	0.001	352
$\Delta ISRV_{USA}$	-4.023	0.000	286	-4.944	0.000	352
ΔIYN_{USA}	-4.178	0.000	286	-4.442	0.000	352

IPSHIN - 1999-2008

Variables *	EU25 (1999-2008)			EU25+ +Japan+Norway+Switzerland+USA (1999-2008)		
	W[t-bar]	P-value	obs.	W[t-bar]	P-value	obs.
ILN	-3.485	0.000	168	-3.539	0.000	252
ILRC	-16.014	0.000	144	-1.488	0.068	252
ILRV	-1.392	0.082	144	-3.481	0.000	224
ISN	-12.589	0.000	216	-10.930	0.000	252
ISRC	-3.136	0.001	216	-4.173	0.000	252
ISRV	-6.592	0.000	144	-3.726	0.000	252
IYN	-3.057	0.001	216	-1.489	0.068	224
$\Delta ILN_{Germany}$	-2.933	0.002	168	-3.120	0.001	252
$\Delta ILRC_{Germany}$	-28.790	0.000	144	-1.796	0.036	252
$\Delta ILRV_{Germany}$	-5.852	0.000	144	-3.411	0.000	224
$\Delta ISN_{Germany}$	-8.573	0.000	216	-8.312	0.000	252
$\Delta ISRC_{Germany}$	-3.114	0.001	216	-4.047	0.000	252
$\Delta ISRV_{Germany}$	-3.998	0.000	216	-4.662	0.000	252
$\Delta IYN_{Germany}$	-2.095	0.018	216	-1.827	0.034	224
ΔILN_{USA}	-2.690	0.004	216	-3.662	0.000	196
$\Delta ILRC_{USA}$	-16.014	0.000	144	-6.672	0.000	168
$\Delta ILRV_{USA}$	-1.391	0.082	144	-14.264	0.000	168
ΔISN_{USA}	-12.589	0.000	216	-6.126	0.000	168
$\Delta ISRC_{USA}$	-3.136	0.001	216	-3.632	0.000	168
$\Delta ISRV_{USA}$	-2.902	0.002	216	-3.324	0.000	168
ΔIYN_{USA}	-2.779	0.003	192	-1.489	0.068	224

*ILN = Nominal long-term interest rates; ILRC = Real long-term interest rates, deflator private consumption; ILRV = Real long-term interest rates, deflator GDP; ISN = Nominal short-term interest rates; ISRC = Real short-term interest rates, deflator private consumption; ISRV = Real short-term interest rates, deflator GDP; IYN = Yield curve; $\Delta ILN_{Germany} = (ILN)_i - (ILN)_{Germany}$; $\Delta ILRC_{Germany} = (ILRC)_i - (ILRC)_{Germany}$; $\Delta ILRV_{Germany} = (ILRV)_i - (ILRV)_{Germany}$; $\Delta ISN_{Germany} = (ISN)_i - (ISN)_{Germany}$; $\Delta ISRC_{Germany} = (ISRC)_i - (ISRC)_{Germany}$; $\Delta ISRV_{Germany} = (ISRV)_i - (ISRV)_{Germany}$; $\Delta IYN_{Germany} = (IYN)_i - (IYN)_{Germany}$; $\Delta ILN_{USA} = (ILN)_i - (ILN)_{USA}$; $\Delta ILRC_{USA} = (ILRC)_i - (ILRC)_{USA}$; $\Delta ILRV_{USA} = (ILRV)_i - (ILRV)_{USA}$; $\Delta ISN_{USA} = (ISN)_i - (ISN)_{USA}$; $\Delta ISRC_{USA} = (ISRC)_i - (ISRC)_{USA}$; $\Delta ISRV_{USA} = (ISRV)_i - (ISRV)_{USA}$; $\Delta IYN_{USA} = (IYN)_i - (IYN)_{USA}$.