International Journal of Business, Human and Social Sciences
ISSN: 2517-9411
Vol:1, No:6, 2007

European and International Bond Markets Integration

Dimitris Georgoutsos[1], Petros M. Migiakis[2]

***Abstract*–**The concurrent era is characterised by strengthened interactions among financial markets and increased capital mobility globally. In this frames we examine the effects the international financial integration process has on the European bond markets. We perform a comparative study of the interactions of the European and international bond markets and exploit Cointegration analysis results on the elimination of stochastic trends and the decomposition of the underlying long run equilibria and short run causal relations. Our investigation provides evidence on the relation between the European integration process and that of globalisation, viewed through the bond markets' sector. Additionally the structural formulation applied, offers significant implications of the findings. All in all our analysis offers a number of answers on crucial queries towards the European bond markets integration process.

***Keywords*–**financial integration, bond markets, cointegration

I. Introduction

THE European bond markets convergence, which has depicted in the period towards the adoption of the common monetary policy, has resulted in an enhanced degree of financial integration. According to the European Central Bank's study [10] on financial integration the bond markets in the European Monetary Union have fully converged towards the introduction of the euro. However the effect of convergence has not yet fully been explored on its determinants. We argue that it should not be taken as granted that the monetary unification, although being of crucial importance, is the unique deterministic factor of the bond markets integration process in Europe. In this context we examine the enhancement of the interactions in the European bond markets due to the ongoing global financial integration and we specify a limited group of international bond markets for which clear evidence of integration are found.

Our investigation begins its examination based on findings of previous works (among others [1], [4], [29]), reporting increased financial integration in the European bond markets, and extends the investigation on the determinants of the integration process. A natural candidate, apart from the already explored monetary unification factor, is the globalisation. As a result we adopt a comparative perspective on the convergence of the European bond markets in the frames of the international bond markets system.

The interactions among international bond markets has been the subject of investigation in recently published papers, rendering thus an increased interest in the further examination of the issue. Previous studies [30] have examined the interactions among five markets –namely those of the United States, Germany, Japan, United Kingdom and Canada– and fails to report significant long run Cointegration relations while describing the causal patterns of the interrelations. Weber [31] examines the convergence of the British interest rates –both short and long term– towards either the European or the US rates. His findings show a slightly enhanced convergence towards the European rates. Finally [21] examine the financial integration process of international bond market –among which some of the European markets and those of the United States and United Kingdom can be found– under the scope of deviation spill-overs among the markets. Their results indicate that integration has advanced in pace with European monetary unification however the risk contained in the markets has followed different patterns in Europe and internationally, as in the former case it has diminished while in the later it has increased.

Our study complements the already reported findings of the aforementioned studies as the further developments of integration and a comparison between the European and the international processes are examined. Specifically our point of view is that the European integration is subject to effects from the external economic and financial environment. The international environment is characterised, according to numerous papers –[3], [23], [24]– by the most tight globalisation process since the end of the 19th century. As a result we compare the strength of the linkages of the European bond markets among a system independent from external influences and a system where European bond markets' linkages are part of the international bond markets interactions. The findings of our empirical investigation are revealing the effects the international financial integration process has on the European bond markets, leading to the overall result that the European bond markets' integration process should not be viewed independently from the globalisation patterns.

Additionally, following previous researchers [20], we do not presuppose that all the markets examined share the same degree of integration but rather examine the incidence of group formulation in the system according to the strength of interactions. This examination leads to significant findings and categorisation of the markets examined

[1] Athens University of Economics and Business, Associate Professor, Department of Accounting and Finance
[2] Corresponding Author, Bank of Greece, Financial Operations Department
Contact Details: email: pmigiakis@bankofgreece.gr tel: *+ 30 210 320 3073*
(The usual disclaimer applies)

according to the strength of their interactions. However this examination serves the overall purpose as well, as it reveals the specific effects of the introduction in the system of the government bond markets of the United States and the United Kingdom for each of the European bond markets examined.

Finally we focus in finding of a system of very close interactions that confirms the underlying hypotheses and that could serve as the nucleus of the international bond markets, for which financial integration has been achieved. We end in identifying a system that fulfils the necessary characteristics and confirm our findings through several tests. Similar results related to short term interest rates are reported in [13] where a specification of a system of increased interactions is provided. The markets reported to share increased interactions and shock transmission, in the aforementioned paper, confirm our findings in the restricted system where financial integration is evident.

In the empirical literature examining European bond markets the German Dominance hypothesis is common ground for the results exploited by researchers, e.g. [2]. However, contradicting evidence have been reported indicating that this stance is not unambiguous –see [7]. Based on these assumptions on the underlying relations we examine the parity relations among the long term interest rates of the government bonds, having direct implications to the existing economic or credit differentiations of the markets.

The paper is structured as follows. Section II discusses methodological issues introducing the empirical and theoretical framework followed during the examination. Section III presents the empirical results and section IV provides a brief discussion. Finally section V concludes.

II. Methodological Framework

Our data set is comprised of monthly yields of government bonds with a term to maturity of ten years of the countries of the European Monetary Union –namely Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal and Spain– and those of the United States and United Kingdom. Data source is the Thomson Financial Datastream and the series used are those reported by the IMF as the benchmark ten year bonds, comprised by on the most recent government bonds' issue with a ten year term to maturity. Specifically we have chosen the ten year issues of the aforementioned markets in order to examine the long term benchmark sector of the bond markets of the countries referred to above. The time period investigated in the present paper covers a time span of approximately ten years –specifically 1997:1 – 2006:1. We do not need to divide the system between the pro-euro and the post-euro eras as this is performed in a more accurate way by the structural methodology implemented.

Stochastic properties of the financial time series are well known and the extended empirical literature applying the Cointegration analysis techniques permits the choice of only brief description of the most important features of the methodology, for the present investigation, to be examined herein. Specifically we adopt the Cointegration analysis techniques introduced in a bilateral framework by [8] and in a multivariate concept by [14], and has been further advanced by [16], [17], [18] and [11]. Specifically interest rates are known to have I(1) characteristics (however unit root and stationarity properties are examined before entering the main investigation through unit root [6] and stationarity [22] tests. As a result our examination depends on revealing the existence of significant long run equilibria among the bond yields examined, the rank of the Cointegration space, the decomposition of the long-run relations and the hypothesis testing.

$$\Delta X_t = \Pi X_{t-1} + \sum_{j=1}^{n} \sum_{i=1}^{k-1} \Gamma_{j_i} \Delta X_{j_{t-i}} + U_t, \quad (1)$$

$$U_t \sim NID(0, \Sigma)$$

The representation of I(1) time series with cointegration characteristics is given by relation 1 in which Γ_{ji} and Π represent matrices of rank. Matrix Π represents the matrix containing the Cointegration relations of the system and Γ_{ji} is the matrix of the coefficients of the lagged variables in each of the equations of the system. Specifically the former coefficient matrix, reports the long run common linear relations and the adjustment coefficients while the later matrix reports the autoregressive relations of the *j* lagged variables of the system, where additionally the interval *i* represents the number of lags inserted in the system. The decomposition of the Cointegration space is given by $\Pi = \alpha\beta'$, where α, β are vectors of rank representing the short run adjusting relations and the long run equilibrium formulating relations respectively, while a restricted constant is contained in the Cointegration space.

The concept of the multivariate Cointegration Analysis for I(1) variables is based on the elimination of the stochastic trends, of non-stationary variables. If all the stochastic trends are eliminated ($r = p$) the time series are stationary, while if no linear combination can be found ($r = 0$), no Cointegration relation exists among the system's variables, indicating that every separate time series is driven by a separate stochastic trend. In all intermediate occasions between no linear combination and stationarity, the time series are driven by several linear combinations and stochastic trends ($0 < r < p$). Consequently our analysis will begin with the determination of the number of linear combinations, or else Cointegration Vectors, that exist in the system.

Ultimately, in a system in which the variables share strong interactions we would expect enhanced number of cointegration relations and subsequently diminishing stochastic trends, thus indicating the convergence of the stochastic processes of all the financial time series of the markets under examination. Specifically following previous researchers' paradigm –[19], [5] and [12]– a necessary condition in order to declare full integration in the system is the finding of a single common stochastic trend, left outside the Cointegration space, to drive the bond markets; thus the results of the rank tests should indicate $p - r = 1$ where p stands for the number of the equations of the system and r is the number of linear combinations that make the variables of the system to be co-integrated.

Additionally we examine the hypotheses of long run exclusion from the Cointegration vectors' formulation, [9] and [15]. The tests are used as indications of significant influence of the long run equilibria by the markets examined. The formula of the hypothesis testing of restricted Cointegration Vectors' coefficients is presented in [15]. In the decomposition of the Cointegration space the examination of the significance of the long run coefficients

is the equivalent of testing for long run exclusion. The test for long run exclusion similarly examines the hypothesis $H_0 : \hat{} = 0$.

Next we examine the decomposition of the cointegration space under the tests introduced by [18] under the hypothesis of interest rate parity. Specifically we estimate the hypothesis that the long term interest rates have achieved a stationary (1 -1)′ equilibrium in the long run and that the premium of the markets of the system against the German Bund or the US Treasury yield is stable. The confirmation of the parity relations is the criterion used to indicate financial integration in bond markets by various empirical papers in the past. One of the early works exploring the effectiveness of the interest rate parity for financial integration is [26], while [27] refer to the parity relations as indicative of integration financial markets.

The aforementioned methodological framework is applied in order to examine the interactions among the European bond markets both in a strictly European and in an enlarged international framework. The first system contains the European bond markets, in the second we introduce the variables of the United States and the United Kingdom's bond market while in the third system only the bond markets of France, Germany, Italy, Netherlands, United States and United Kingdom are present. We compare the systems for the rank of their Cointegration space, their exogeneity characteristics and the parity relations. Our findings indicate that the second system performs much better, in terms of elimination of the stochastic trends, exogeneity characteristics and parity relations. Additionally a more thorough examination of the system's interactions permits us to identify a group of bond markets for which all the financial integration criteria hold true, presented in the third system.

III. Empirical Findings

In order to proceed to the examination of the Cointegration characteristics of the systems we examine we need firstly to examine the stationarity characteristics of the variables under examination. Although it is well known that interest rates' series are characterized by their I(1) stochastic processes one needs always to perform the relevant tests. We apply the Dickey-Fuller and the KPSS tests and the results are reported in Tables I[a] and I[b] respectively. The tests unambiguously state the I(1) nature of the series we use, thus we apply Cointegration Analysis for I(1) series..

TABLE I[a]
UNIT ROOT TESTS (D-F)

	Levels		1st Differences	
	l=0	*l=5*	*l=0*	*l=5*
Austria	-1.088	-1.809	-10.130	-3.889
Belgium	-1.157	-1.693	-9.879	-4.072
Finland	-1.349	-1.795	-10.427	-4.235
France	-1.325	-1.748	-9.731	-4.225
Germany	-1.411	-2.014	-10.242	-4.273
Greece	-1.342	-1.441	-10.926	-4.057
Ireland	-1.618	-2.214	-10.171	-4.202
Italy	-2.305	-2.770	-9.509	-3.570
Netherlands	-1.195	-1.718	-10.419	-4.221
Portugal	-1.735	-2.000	-6.071	-5.241
Spain	-1.692	-2.164	-9.894	-3.788
United States	-1.906	-2.062	-10.402	-4.824
Un. Kingdom	-2.661	-3.112	-11.730	-4.602

Critical Values:*l=0: 1%= -3.491, 5%=-2.888, 10%=-2.581, l=5: 1%= -3.494, 5%=-2.889, 10%=-2.585*

TABLE I
STATIONARITY TESTS (KPSS)

	Levels		1st Differences	
	l=0	*l=5*	*l=0*	*l=5*
Austria	1.071	0.207	0.065	0.056
Belgium	1.031	0.201	0.062	0.056
Finland	0.889	0.177	0.065	0.067
France	0.969	0.192	0.058	0.054
Germany	0.778	0.156	0.057	0.053
Greece	0.786	0.159	0.050	0.051
Ireland	0.706	0.139	0.073	0.064
Italy	0.627	0.124	0.122	0.100
Netherlands	1.001	0.198	0.055	0.053
Portugal	0.781	0.152	0.103	0.083
Spain	0.713	0.140	0.111	0.094
Un. States	0.481	0.121	0.041	0.049
Un. Kingdom	1.063	0.218	0.052	0.066

Critical Values:*10%=0.119, 5%= 0.146, 1%= 0.216*

Table II contains the results of the Cointegration rank tests for the three systems we examine. The tests indicate that there exist significant stationary long run equilibria

TABLE II
COINTEGRATION RANK TESTS

	p = 12	*p* = 11	*p* = 10	*p* = 9	*p* = 8	*p* = 7	*p* = 6	*p* = 5	*p* = 4	*p* = 3	*p* = 2	*p* = 1
$\hat{}_{Trace}$ *	348.98	291.40	244.15	202.92	165.5	131.70	102.14	76.07	53.12	34.91	19.96	9.24
$\hat{}_{max}$ *	77.35	69.74	63.57	57.42	52.00	46.45	40.30	34.40	28.14	22.00	15.67	9.24
The European System												
$\hat{}_{Trace}$		475.05	338.55	246.27	182.73	133.48	94.92	59.25	37.15	21.43	9.87	1.94
$\hat{}_{max}$		136.50	92.28	63.54	49.24	38.56	35.67	22.10	15.72	11.56	7.93	1.94
The International System												
$\hat{}_{Trace}$	776.32	609.44	475.14	371.32	285.67	209.17	150.87	103.27	68.91	45.90	25.47	8.54	2.56
$\hat{}_{max}$	166.88	134.30	103.82	85.65	76.50	58.30	47.60	34.36	23.01	20.43	16.93	5.98	2.56
FR, DE, IT, NE, US, UK												
$\hat{}_{Trace}$							262.50	122.66	76.74	47.09	21.27	8.86
$\hat{}_{max}$							139.85	45.92	29.65	25.81	12.41	8.86

Notes: In Table 2 the tests refer to the number of the linear combinations contained in the Cointegration space under the definition $< n - p$ where n represents the number of the system's variables. The tests are performed against the alternative of the number of stochastic trends p *.* Critical Values of the tests $_{Trace}$ and $\hat{}_{max}$ as reported in [27] case 1* in a confidence interval of 95%.** Critical values referred for the case of 12 stochastic trends are the relevant values of [24] for a confidence interval of 95%.

among the bond markets we examine. Specifically for the case of the strictly European system, the number of Cointegration vectors is found to be five, leaving thus six stochastic trends outside the Cointegration space. For the system containing the whole European bond markets system and the US and UK bond markets' variables the vectors that form the Cointegration space are indicated to be eight. As a result the inclusion of the United States and the United Kingdom variables in the system, although increasing the systems variables by two, decreases the stochastic trends compared to the European system, when the Cointegration relations are taken into consideration. This finding indicates enhanced long run relations in the international bond markets framework compared to the European system. Additionally the system consisted of the markets of France, Germany, Italy, the Netherlands, United States and United Kingdom is reported to incorporate significant cointegrating relations leaving a unique stochastic trend to drive the system.

This last result according to previous empirical literature – [12] and [19] among others – is indicating strong long run relations in the direction of full financial integration. However more thorough analysis is needed in order to entail acquire robust results from the comparison of the two systems. Although financial integration is an issue that we approach later on through additional tests and examinations, this indication is in the direction of enhancement of the interactions. Table III reports the results of the long run exclusion tests.

TABLE III
LONG RUN EXCLUSION TESTS $H_0 : \beta_i = 0$

	European System		International System		Restricted System	
	$X^2(5)$	p-value	$X^2(8)$	p-value	$X^2(5)$	p-value
Austria	15.88	0.01	70.30	0.00	-	-
Belgium	12.83	0.03	36.88	0.00	-	-
Finland	11.76	0.04	35.68	0.00	-	-
France	65.67	0.00	94.75	0.00	39.07	0.00
Germany	32.60	0.00	75.86	0.00	17.53	0.00
Greece	7.19	0.21	64.66	0.00	-	-
Ireland	17.11	0.00	65.60	0.00	-	-
Italy	7.37	0.19	41.38	0.00	51.90	0.00
Neth.	23.80	0.00	73.49	0.00	30.80	0.00
Portugal	28.14	0.00	68.62	0.00	-	-
Spain	5.13	0.40	43.92	0.00	-	-
Un. State	-	-	63.31	0.00	24.03	0.00
Un. King	-	-	65.73	0.00	12.81	0.03

Overall the results of the long run exclusion tests support the findings of the Cointegration rank tests and enhance our view in the formulation of the long run equilibria of the bond markets examined. Specifically in the European bond markets system there exist indications that several markets do not significantly affect the long run equilibria; namely Greece, Spain and Italy can be excluded from the Cointegration vectors' formulation while, if we accepted higher confidence intervals than 95% the markets of Belgium and Finland could be excluded as well. As a result this finding indicates that the long run equilibrium of the European system that is encompassed in the Cointegration space of the first system is formulated by the rest of the system's variables. This finding indicates that, although convergence among European bond markets has progressed significantly, still the long run equilibria do not encompass all the systems variations and long run trends.

TABLE IV
PARITY RELATIONS (EUROPEAN SYSTEM)

$H_0 : (\beta_{Ger} - \beta_i)' = (1-1)'$	$X^2(6)$	p-value
$H_0 : (\hat{\ }_{Ger} \quad \hat{\ }_{Aus})'$	34.39	0.00
$H_0 : (\beta_{Ger} - \beta_{Bel})'$	34.20	0.00
$H_0 : (\beta_{Ger} - \beta_{Fin})'$	30.40	0.00
$H_0 : (\beta_{Ger} - \beta_{Fra})'$	18.74	0.00
$H_0 : (\beta_{Ger} - \beta_{Gre})'$	28.94	0.00
$H_0 : (\beta_{Ger} - \beta_{Ire})'$	28.82	0.00
$H_0 : (\beta_{Ger} - \beta_{Ita})'$	12.76	0.05
$H_0 : (\beta_{Ger} - \beta_{Net})'$	28.79	0.00
$H_0 : (\hat{\ }_{Ger} \quad \hat{\ }_{Por})'$	33.81	0.00
$H_0 : (\hat{\ }_{Ger} \quad \hat{\ }_{Spa})'$	30.12	0.00

Table IV reports the tests of the interest rate parity among the European bond markets. As indicated the parity relations are not confirmed in any case other than the relation between the Italian and the German government bonds. This effect is in line with the overall findings although indicating divergence from the case of full integration, an effect that may be due to the inclusion of pre-euro and early euro-period observations. However it enhances the basis for the comparative examination with the two other systems we examine.

As indicated in Table III long run exogeneity effects are lifted in the case we examine the interactions in the international bond markets and in the restricted system. This effect indicates that the variables found to be excluded from the formulation of the long run structure of the system enter in the Cointegration relations of the international and the restricted systems. As a consequence the markets that were found to be excluded from the Cointegration relations of the European systems are reflected in a more effective fashion by the international system. As a result the interactions are found again to be enhanced by the introduction of the US and the UK bond markets, supporting thus the Cointegration rank tests' results. The parity relations' tests' results are presented in Tables V and VI below.

TABLE V
PARITY RELATIONS (INTERNATIONAL SYSTEM)

$H_0 : (\quad_{Ger} \quad_i)' \ (1 \ 1)'$	$X^2(5)$	p-value	$H_0 : (\beta_{US} - \beta_i)' = (1-1)'$	$X^2(5)$	p-value
$H_0 : (\beta_{Ger} - \beta_{Aus})'$	16.64	0.01	$H_0 : (\quad_{US} - \quad_{Aus})'$	16.37	0.01
$H_0 : (\beta_{Ger} - \beta_{Bel})'$	16.49	0.01	$H_0 : (\bar{\ }_{US} - \bar{\ }_{Bel})'$	15.42	0.01
$H_0 : (\beta_{Ger} - \beta_{Fin})'$	17.79	0.00	$H_0 : (\quad_{US} - \quad_{Fin})'$	19.01	0.00
$H_0 : (\beta_{Ger} - \beta_{Fra})'$	16.84	0.00	$H_0 : (\bar{\ }_{US} - \bar{\ }_{Fra})'$	15.63	0.01
$H_0 : (\beta_{Ger} - \beta_{US})'$	14.31	0.01	$H_0 : (\quad_{US} - \quad_{Ger})'$	14.31	0.01
$H_0 : (\beta_{Ger} - \beta_{Gre})'$	10.33	0.07	$H_0 : (\quad_{US} - \quad_{Gre})'$	26.13	0.00
$H_0 : (\bar{\ }_{Ger} \quad \bar{\ }_{Ire})'$	11.09	0.03	$H_0 : (\bar{\ }_{US} - \bar{\ }_{Ire})'$	18.87	0.00
$H_0 : (\beta_{Ger} - \beta_{Ita})$	12.31	0.03	$H_0 : (\quad_{US} - \quad_{Ita})'$	13.44	0.02
$H_0 : (\beta_{Ger} - \beta_{Net})$	16.93	0.00	$H_0 : (\quad_{US} - \quad_{Net})'$	15.55	0.01
$H_0 : (\beta_{Ger} - \beta_{Por})'$	12.94	0.02	$H_0 : (\quad_{US} - \quad_{Por})'$	16.91	0.00
$H_0 : (\bar{\ }_{Ger} \quad \bar{\ }_{Spa})'$	12.30	0.03	$H_0 : (\bar{\ }_{US} - \bar{\ }_{Spa})'$	18.66	0.00
$H_0 : (\beta_{Ger} - \beta_{UK})'$	14.96	0.01	$H_0 : (\quad_{US} - \quad_{UK})'$	15.35	0.01

As reported in Table VI the European bond markets, if examined as part in the frames of the international bond markets system, are indicated to be affected by parity relations formulated in the long run against the German Bund. Specifically the parity relations with the German Bund are confirmed for the case of Greece and could not be rejected, under an enhanced confidence interval, for the majority of the European bond markets when including the

TABLE VI
PARITY RELATIONS (RESTRICTED SYSTEM)

$H_0:(\beta_{Ger}-\beta_i)'=(1-1)'$	$X^2(1)$	p-value	$H_0:(\beta_{US}-\beta_i)'=(1-1)'$	$X^2(1)$	p-value
$H_0:(\hat{}_{Ger}-\hat{}_{Fra})'$	3.01	0.08	$H_0:(\hat{}_{US}-\hat{}_{Fra})'$	2.55	0.11
$H_0:(\hat{}_{Ger}-\hat{}_{US})'$	1.69	0.19	$H_0:(\bar{}_{US}-\bar{}_{Ger})'$	1.69	0.19
$H_0:(\hat{}_{Ger}-\hat{}_{Ita})'$	0.68	0.41	$H_0:(\bar{}_{US}-\bar{}_{Ita})'$	3.55	0.06
$H_0:(\hat{}_{Ger}-\hat{}_{Net})'$	3.21	0.07	$H_0:(_{US}-_{Net})'$	2.54	0.11
$H_0:(\hat{}_{Ger}-\hat{}_{UK})'$	2.26	0.13	$H_0:(_{US}-_{UK})'$	0.55	0.46
$H_0:(\hat{}_{Fra}-\hat{}_{Ita})'$	0.01	0.91	$H_0:(\bar{}_{Ita}-\bar{}_{Net})'$	0.00	0.98
$H_0:(\hat{}_{Fra}-\hat{}_{UK})'$	2.36	0.12	$H_0:(_{Ita}-_{UK})'$	1.95	0.16
$H_0:(\hat{}_{Fra}-\hat{}_{Net})'$	0.51	0.48	$H_0:(\hat{}_{UK}-\hat{}_{Net})'$	2.40	0.12

markets of the United States and United Kingdom. This effect stems from the improvement of the properties of the Cointegration space, thus it can be attributed to the better scope for investigation these markets offer, as their effects on the European bond markets are important. Additionally this result is further supported by the finding that some of the markets –namely Austria, Belgium, France, Germany, Italy and the Netherlands– are found to be subject of parity relations against the United States. This finding further underlines the significance of the Treasuries' market for the international bond markets.

The relations of the last, restricted, system are characterised by full elimination of the stochastic trends and absence of exogeneity properties in the long run. This finding is straight forward and in line with the finding of the international system tests. However parity relations should be examined as well. Specifically should indications of financial integration among the bond markets of France, Germany, Italy, the Netherlands, United States and United Kingdom, already extracted by the cointegration's space rank tests, be supported parity relations should be confirmed by the relevant tests. Table VII presents the relevant results of the (1 -1)` decomposition tests.

TABLE VII
THE COINTEGRATION SPACE OF THE RESTRICTED SYSTEM

$H_0:(\beta_{Ger}-\beta_i)'$			$H_0:(\hat{}_{US}-\hat{}_i)'$		
$X^2(1)$	8.79	p-value 0.12	$X^2(1)$	8.99	p-value 0.11
$VEC_1:(\hat{}_{Ger}-\hat{}_{Fra}+0.080)'$			$VEC_{1*}:(_{US}-_{Fra}\ 0.392)'$		
$VEC_2:(\hat{}_{Ger}-\hat{}_{Ita}+0.255)'$			$VEC_{2*}:(_{USr}-_{Ita}\ 0.214)'$		
$VEC_3:(\hat{}_{Ger}-\hat{}_{Net}+0.096)'$			$VEC_{3*}:(\beta_{US}-\beta_{Net}-0.377)'$		
$VEC_4:(\hat{}_{Ger}-\hat{}_{US}+0.436)'$			$VEC_{4*}:(\bar{}_{US}-\bar{}_{Ger}\ 0.471)'$		
$VEC_5:(\hat{}_{Ger}-\hat{}_{UK}+0.377)'$			$VEC_{5*}:(_{US}-_{UK}\ 0.072)'$		

As is reported in Table VII the tests that the relations among the system's variables are characterised by parity of the underlying interest rates is confirmed. Additionally the interest rates parity hypothesis is accepted for all the bilateral relations, indicating that the system's bond markets formulate their long run processes in a very close interactions fashion. This finding is an indication of financial integration for the system. Additionally the results of interest rates parity are in line with findings of [13] for the money markets originating from approximately the same countries. The significance of the parity relations indicated in Table VI points underlines the strong interactions among the bond markets of the system and the integration characteristics that are more strongly reported in an international framework rather than a strict European. Additionally the omission of the smaller markets serves as a clarification factor and highlights their position as outliers of the system, at least under the criterion of full financial integration.

Although parity relations are evident in the international system, containing all the markets, as well the (1 -1)` structure of the relations among the variables in the long run is reported to allow the significant representation of the Cointegration space. As a result in the case of the interactions among the six markets that comprise the restricted system the parity tests are quite revealing. Specifically in the restricted system the parity relations of the bond markets examined the long run equilibria are formulated by the interest rates of the government bonds of the system in a close (1 -1)` fashion against the German Bund or the US Treasury bond. Additionally premia are included in the relevant cointegrating relations capturing the stationary spreads among the bonds examined.

IV. DISCUSSION OF THE RESULTS

The investigation of the Cointegration relations among the systems examined in this paper, revealed interesting evidence that the European bond markets are subject to enhanced interactions when examined under the scope of international financial markets convergence, rather than strictly the European financial integration process. Specifically the European bond markets are indicated to be subject of enhanced long run equilibrium relations and overpass their exogeneity characteristics when the US and the UK markets are introduced in the system. This result reflects the interaction between the two processes that mainly characterise the economic activity in the concurrent period; globalisation and European integration.

Additionally the investigation of the underlying relations of the three systems permits an informal categorisation of the markets according to the strength of their interactions with the international bond markets system. Specifically we have found that the 'core' of the system is comprised by the markets of France, Germany, Italy, the Netherlands, United States and United Kingdom, for which financial integration evidence are provided by the tests. Additionally the tests of parity among interest rates, in the international framework, indicate the markets that are closer connected to the Germany, as a European benchmark rather than the United States, as the international benchmark. Those are the 'European periphery' namely Greece, Ireland, Portugal and Spain, while France and the Netherlands are indicated to interact more closely with the United States Treasury bond. For the first market this result is quite expected as it is seen as a potential benchmark market as well –see [7].

Finally equivalently important is the establishment of evidence of financial integration in the case of the last-restricted system. The results of the system of the six large bond markets contained in the last system should be interpreted as indicating close interactions among the bond markets of France, Germany, Italy, the Netherlands, United States and United Kingdom. Additionally this result permits the claim that when the 'outliers' of the system are excluded, the integration characteristics of the European bond markets with those of the US and UK become clarified.

V. Concluding Remarks

All in all our investigation indicates that the relationship between the globalisation process and its equivalent European integration are not at all independent but rather they render causality characteristics in a bilateral fashion. Additionally the financial integration process in the European bond markets should be viewed in relation to the external environment of financial markets in order to be better comprehended. However the assessment of the convergence of the European markets should also be comparative to the convergence towards the international financial system in order to enable the efficient investigation of advantages from the integration process.

References

[1] Baele D., Ferrando A., Hordahl P., Krylova E. and Monnet C. (2004) 'Measuring Financial Integration In the Euro Area' *European Central Bank* Occasional Paper Series no 14

[2] Baum C. and Barkoulas J. (2006) 'Dynamics of Intra-EMS Interest Rate Linkages' Journal of Money, Credit and Banking vol. 38(2)

[3] Bordo M., Eichengreen B. and Kim J. (1998) 'Was There Really an Earlier Period of International Financial Integration Comparable to Today?' National Bureau of Economic Research working paper no 6738

[4] Codogno L., Favero C. and Missale A. (2003) 'Yield Spreads on EMU Government Bonds' Economic Policy, pp 503-532

[5] Corhay A., Tourani Rad A. and Urbain J.-P. (1993) 'Common Stochastic Trends in European Stock Markets' *Economics Letters* pp. 385-390

[6] Dickey, D.A. and Fuller, W.A. Distribution of the estimates for autoregressive time series with a unit root. Journal of the American Statistical Association 1979; 74; 427-431.

[7] Dunne P., Moore M. and Portes R. (2002) 'Defining Benchmark Status: An Application Using Euro-Area Bonds' *National Bureau of Economic Research*, working paper no 9087

[8] Engle R. and Granger C. W. (1987) 'Co-Integration and Error Correction: Representation, Estimation And Testing' *Econometrica* pp. 251-276

[9] Engle R., Hendry D. and Richard J. F. (1983) 'Exogeneity' Econometrica pp.277-304

[10] European Central Bank (2005) 'Indicators of Financial Integration in the Euro Area'

[11] Haug A., MacKinnon J. and Michelis L. (2000) 'European Monetary Union: A Cointegration Analysis' *Journal of International Money and Finance* v. 19 pp.419-432

[12] Holmes M. and Maghrebi N. (2006) 'Are International Real Interest Rate Linkages Characterised by Asymmetric Adjustments? Journal of International Financial Markets, Institutions and Money vol. 16

[13] Johansen S.(1988) Statistical Analysis of Cointegrating Vectors. Journal of Economic Dynamics and Control;12; 231-254.

[14] Johansen S. (1992) 'Testing Weak Exogeneity And The Order of Cointegration In UK Money Demand Data' *Journal of Policy Modeling* pp. 313-334

[15] Johansen S. (1991) 'Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models' *Econometrica* pp. 1551-1580

[16] Johansen S. and Juselius K. (1992) 'Testing Structural Hypotheses In A Multivariate Cointegration Analysis of The PPP And The UIP For UK' *Journal of Econometrics* pp. 211-244

[17] Johansen S. and Juselius K. (1994) 'Identification of The Long-Run And The Short-Run Structure. An Application To The ISLM Model' *Journal of Econometrics* pp. 7-36

[18] Kasa, K. (1992). 'Common stochastic trends in international stock markets' Journal of Monetary Economics 9: 95–124.

[19] Kiehlborn T. and Mietzner M. (2005) 'EU Financial Integration: Is There a 'Core Europe'? Evidence from a Cluster Based Approach' Johann Wolfgang Goethe-Universität working paper no. 130

[20] Kim S.-J., Lucey B. and Wu E. (2006) 'Dynamics of Bond Market Integration Between Established and Accession EU Countries' Journal of International Financial Markets, Institutions and Money vol. 16(1) pp.41-56

[21] Kwiatkowski, D., P. C. B. Phillips, P. Schmidt, and Y. Shin Testing the Null Hypothesis of Stationarity against the Alternative of a Unit Root: How Sure Are We That Economic Time Series Have a Unit Root?. Journal of Econometrics 1992; 54; 159-178.

[22] Lothian J. (2000) 'Capital Market Integration and Exchange-Rate Regimes in Historical Perspective' Research in Banking and Finance, vol. 1

[23] Lothian J. (2001) 'Financial Integration Over the Past Three Centuries' Independent Institute working paper no. 26

[24] MacKinnon J., Haug A. and Michelis L. (1999) 'Numerical Distribution Functions of Likelihood Ratio Tests for Cointegration' *Journal of Applied Econometrics* pp.563-577

[25] Mishkin F. (1984) 'Are Real Interest Rates Equal Across Countries? An Empirical Investigation of International Parity Conditions' The Journal of Finance vol. 39(5)

[26] Mussa M. and Goldstein M. (2006) 'The Integration of World Capital Markets'

[27] Osterwald-Lennum M.. A Note with Fractiles of the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistics: Four Cases. Oxford Bulletin of Economics and Statistics 1992; 54; 461-472.

[28] Pagano M. and von Thadden L. (2004) 'The European Bond Markets Under EMU' *Oxford Review of Economic Policy*

[29] Yang J. (2006) 'International Bond Markets Linkages: A Structural VAR Analysis' Journal of International Financial Markets, Institutions and Money

[30] Weber E. (2006) 'British Interest Rate Convergence Between the US and Europe: A Recursive Cointegration Analysis' SFB 649 Discussion Paper 2005-2006