Stock Market Integration And The Pre- And Post-1999 Currency Union: The Case Of The Euro Zone

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Results of this study indicate that the three different stages of the currency union – pre-anticipated union, fully anticipated union based upon Hardouvelis, Malliaropulos and Priestley's (2006) study, and post-union periods – show extremely few bidirectional causations from the 1990s, the 2000s and the post-1980s sample periods. This implies that the EU stock markets did not achieve full integration during the 1990s and onward. The strength of both short-run and long-run causal relations actually fell during the 1990s and the 2000s compared to their counterparts during the pre-1990s. Our findings thus do not support Hardouvelis, Malliaropulos and Priestley's (2006) conclusion of full integration of the EU stock markets during the 1990s and onward.

Field of Research: Financial Economics

1. Introduction

The landscape of the world financial markets has changed dramatically over the past thirty years. This is reflected in the stock market integration literature which shows that major stock markets in the world have become more integrated in recent years (i.e., Blackman, Holden and Thomas 1994; McInish and Lau 1993; Arshanapali and Doukas 1993; Bekaert and Harvey 1995; Longin and Solnik 1995; Gjerde and Saettem 1995; Meric and Meric 1998; Friedman and Shachmurove 1997 Hardouvelis, Malliaropulos and Priestley 2006). Gjerde and Saettem (1995) show from daily data for the period 1983-1994 that there is increased integration among the stock markets of UK, Germany, France, Switzerland, Italy, Sweden, Denmark, and Norway. Similarly, Friedman and Shachmurove (1997) also uncover high correlations among the stock markets of Belgium, Denmark, France, Germany, Italy, Netherlands and Spain for the period 1988-1994, thus implying increased stock market integration.

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A recent study by Hardouvelis, Malliaropulos and Priestley (2006) concludes that the stock markets of Austria, Belgium-Luxembourg, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal, Spain and United Kingdom are fully integrated during the 1990s. The authors attribute full integration of the EU stock markets during the 1990s to the prospect of the monetary union. If their findings and conclusion of full integration of the EU stock markets are to be robust, the 2000s sample should also capture full integration in light of the currency union in January 1999, gradual regulatory harmonization among European stock markets and the abolition of various restrictions on nonresidents. This study thus re-examines the EU stock market integration for three different stages of the currency union – pre-anticipated union, fully anticipated union based upon Hardouvelis, Malliaropulos and Priestley's (2006) study, post-union periods. The degree of market integration of the three stages of the currency union is evaluated using the pre-1990, the 1990s, and the 2000s sample periods. For completeness, we further evaluate market integration for the post-1980s period and the full sample period. The plan of the paper is as follows. Section 2 describes the data and the method of analysis. Section 3 reports the empirical results along with a series of specification tests. The last section is of summary and conclusion.

2. The Method And The Data

The relationship among equity price indexes of the EU stock markets can be specified as follows:

$$P_{it} = f(P_{j\ t=1t,\ 2t,\ \ldots,10\ t}), \qquad (1)$$

where P_{it} is the stock market price index of country i and P_{jt} is the stock market price index of country j. In other words, if P_{it} represents the price index of the German stock market, its index is influenced by the indexes of the other EU stock markets. A method of assessing stock market integration between a pair of EU price indexes, while controlling for the other EU price indexes, is to test for the short-run dynamic and long-run equilibrium relationships using the VECM. This section first describes the methodology and then conducts analysis. We first begin with an integration analysis to assess the degree of integration of the variables under investigation. This paper adopts the Phillip-Perron (1987) unit root test to determine the degree of integration of the variables. The second step is to test for cointegration using the Engle-Granger (1987) two-step approach for each of the VARs constructed in levels. Our causality tests are preceded by cointegration testing since the presence of cointegrated relationships has implications for the way in which causality testing is carried out. If cointegration is detected, the third step is to test for causality by employing the appropriate types of causality tests available in the recent literature. This study adopts the Engle-Granger (1987) two-step cointegration method. According to Engle and Granger, cointegrated variables must have an error correction representation in which an error correction term must be incorporated into the model. Accordingly, a vector

error-correction model (VECM) is formulated to reintroduce the information lost in the differencing process, thereby allowing for long-run equilibrium as well as short-run dynamics. By incorporating an error term in equation (2), the following VECM model is formulated below.

$$\Delta y_t = \alpha + \sum_{j=1}^{k} \beta_i \Delta y_{t-j} + \sum_{j=1}^{k} \gamma_i \Delta x_{t-l} + \lambda \pi_{t-1} + \nu_t \qquad (2)$$

where Δy_t is the German price index, Δy_{t-1} is lag 1 of the German price index, Δx_{t-1} is lag 1 of those EU price indexes, k is the number of lags, u_t is an error term. Lastly, π_{t-1} is the lagged value of an error correction term from the cointegration regression:

$$Y_t = \eta + \kappa T + \sum_{k=1}^{m} \rho_k X_{tk\,k} + \pi_t, \qquad (3)$$

where T is the trend.

Including the error correction term (π_{t-1}) and the only differenced variables provides direct tests of both the short-run and the long-run relationships from Germany=s price index to each EU price index. This study uses weekly Morgan Stanley Country Equity Price Index (MSCI) denominated in the Euro. Datastream provides Euro-denominated weekly data for Austria, Belgium, France, Germany, Italy, Netherlands, and Spain. The sample period is from February 4, 1970 to May 14, 2008.

3. Empirical Findings

When dealing with time series data, one must evaluate each series to determine whether it is stationary or nonstationary. As shown in Table 1, the estimated statistics of the log levels of each country=s price index are not statistically significant at the 5 percent. When price indexes are in first differences, the PP tests reject nonstationarity at the 5 percent level. We thus conclude that all series are I(1). The subsequent analysis uses the series in first differences. This study now proceeds to test for the presence of a common trend or equivalently a long-run cointegrating relationship among the variables. In Tables 2, the results of the cointegration test statistics point to the conclusion that non-cointegration can be rejected either at the 1% level, the 5% level or the 10% level when controlling for the other five EU price indexes, except one EU price index. When the price index of Spain is the dependent variable, non-cointegration cannot be rejected even marginally at the 10% level. Cointegration implies the existence of causality at least in one direction, but it does not indicate the direction of the causal relationship. We thus perform the VECM-based causality tests, except when the price index of Spain is the dependent variable, to determine the direction of the causality. Here, the Granger causality tests are applied. Tables

3 and 4 summarize results from the five different sample periods.

Table 1: Phillip-Perron Unit Root Tests

	Level	First difference
Country	t-stat	t-stat
AUSTRIA	-1.218 (12)	-42.005 (11)
BELGIUM	-2.280 (2)	-48.186 (1)
FRANCE	-2.131 (3)	-51.547 (2)
GERMANY	-2.215 (3)	-48.691 (2)
ITALY	-2.554 (5)	-45.569 (4)
NETHERLANDS	-2.038 (9)	-50.708 (8)
SPAIN	-1.168 (2)	-48.885 (1)

*Critical t-values at the 1% and 5% levels are -3.968and -3.415. Parentheses indicate the lag length selected by the AIC. We include the intercept and the trend.

**All six series in first differences for both samples reject the unit-root hypothesis at the 1% level.

Table 2: Cointegration Results

Dependable Variable	Independent Variable	t-value
AUSTRIA	GERMANY	-4.227[c]
GERMANY	AUSTRIA	-4.805[c]
BELGIUM	GERMANY	-4.604[c]
GERMANY	BELGIUM	-4.805[c]
FRANCE	GERMANY	-3.322[a]
GERMANY	FRANCE	-4.805[c]
ITALY	GERMANY	-3.978[c]
GERMANY	ITALY	-4.805[c]
NETHERLANDS	GERMANY	-4.930[c]
GERMANY	NETHERLANDS	-4.805[c]
SPAIN	GERMANY	-1.521
GERMANY	SPAIN	-4.805[c]

Critical values at the 1%, 5% and 10% levels respectively are -3.968, 3.415, and -3.129

[a, b, and c] respectively are statistically significant at the 10%, 5%, and 1% levels.

Note: We controlled for the other 5 price indexes. All the cointegration equations include the trend and the intercept.

As shown in Table 3, the pre-1990s sample shows much more frequent short-run and long-run causal relations between price indexes of Germany and of each EU country. The pre-1990s sample shows 5 short-run causal relationships from Germany to Austria, France, Italy, Netherlands, and Spain and 4 causal relations from Austria, Belgium, France, and Spain to Germany. Also, there are 2 statistically significant error correction terms from Germany to France and Italy and all are statistically significant when the dependent variable is Germany. From the 1990s sample, we find 2 short-run causal relations from Germany to Belgium and Spain and 2 short-run dynamic causal relations from Austria and Spain to Germany. All the error correction terms from the price index of each EU equity market to the price index of Germany are statistically significant at least at the 10% level. Only 1 error correction term from Germany to Italy is statistically significant at the 5% level. From the 2000s sample, we do not find any short-run causal relation from Germany to any EU country and 2 statistically significant error correction terms from Germany to Austria and Netherlands. When the dependent variable is Germany, we find no short-run causal relation from each EU equity market to the German market, but all the error correction terms are statistical significant at least at the 10% level.

Table 3: Results of the Error-Correction Model

Variable			pre-1990 sample		1990s sample		2000s sample	
Dep. Var.	Indep. Var.	Error-correct	F-value	t-value	F-value	t-value	F-value	t-value
Δaustria	Δgermany	ec_{-1}	4.170[c]	-1.195	1.098	-1.326	1.169	-2.243[b]
Δgermany	Δaustria	ec_{-1}	7.987[c]	-4.015[c]	3.073[c]	-2.361[b]	2.274[b]	-1.152
Δbelgium	Δgermany	ec_{-1}	1.302	-0.446	2.960[c]	-0.955	0.848	-1.222
Δgermany	Δbelgium	ec_{-1}	3.598[c]	-4.015[c]	1.886	-2.361[b]	0.924	-1.152
Δfrance	Δgermany	ec_{-1}	3.328[c]	-3.766[c]	1.471	-1.304	0.427	- 0.406
Δgermany	Δfrance	ec_{-1}	3.484[c]	-4.015[c]	0.346	-2.361[b]	0.793	-1.152
Δitaly	Δgermany	ec_{-1}	2.189[b]	-3.819[c]	1.778	-1.985[b]	1.105	-1.724
Δgermany	Δitaly	ec_{-1}	1.430	-4.015[c]	1.918	-2.361[b]	2.307[b]	-1.152
Δnetherlands	Δgermany	ec_{-1}	2.531[b]	-0.838	1.624	-0.742	0.636	-3.338[c]
Δgermany	Δnetherlands	ec_{-1}	0.444	-4.015[c]	1.610	-2.361[b]	0.378	-1.152
Δspain	Δgermany		3.466[c]		3.275[c]		0.691	
Δgermany	Δspain	ec_{-1}	1.902	-4.015[c]	2.244[b]	-2.361[b]	0.401	-1.152

[a], [b], and [c] respectively are statistically significant at the 10%, 5%, and 1% levels.

Note: The F-value is used to test H_0: $\gamma_1 = \gamma_2 = \ldots = \gamma_9 = 0$
The t-value is used to test H_0: $\lambda \geq 0$

Table 4 shows the results of the post-1980s and of the full sample periods. The

combined sample period of the anticipated currency union and the post-currency union also does not indicate full market integration. Only one short-run causal relation from Germany to Spain and two short-run causal relations from Austria and Spain to Germany can be detected. However, the post-1980s sample period reveals more statistically significant error-correction terms. All error-correction terms are statistically significant when the independent variable while only one is statistically significant when the dependent variable is Italy. Unlike the post-1980s sample period, all short-run causal relations, except Austria, are statistically significant when the independent variable is Germany. Similarly, all short-run causal relations, except France, are significant when the dependent variable is Germany. There is only one statistically significant error-correction term with Germany as the independent variable, but all are significant with Germany as the dependent variable. The pre-1990s, the 1990s and the 2000s sample periods exhibit different directions of the causal relationship between each EU equity price index and the German price index. If the EU stock markets were fully integrated during the 1990s, the 2000s and the post-1980s, we should have uncovered numerous bidirectional short-run and long-run causal relations from all three subsamples. In fact, we have uncovered more bidirectional short-run causal relations from the pre-1990s sample period and the full sample.

Table 4: Results of the Error-Correction Model

Variable			post-1980 sample		full sample	
Dep. Var.	Indep. Var.	Error-correct	F-value	t-value	F-value	t-value
Δaustria	Δgermany	ec_{-1}	1.098	-1.326	1.574	-1.028
Δgermany	Δaustria	ec_{-1}	3.073[c]	-2.361[b]	5.094[c]	-2.994[c]
Δbelgium	Δgermany	ec_{-1}	2.960[c]	-0.955	4.424[c]	-1.310
Δgermany	Δbelgium	ec_{-1}	1.886	-2.361[b]	3.141[c]	-2.994[c]
Δfrance	Δgermany	ec_{-1}	1.471	-1.304	3.014[c]	-1.881
Δgermany	Δfrance	ec_{-1}	0.586	-2.361[b]	1.047	-2.994[c]
Δitaly	Δgermany	ec_{-1}	1.778	-1.985[b]	2.992[c]	-1.426
Δgermany	Δitaly	ec_{-1}	1.918	-2.361[b]	3.019[c]	-2.994[c]
Δnetherlands	Δgermany	ec_{-1}	1.624	-0.742	2.686[b]	-0.577
Δgermany	Δnetherlands	ec_{-1}	1.610	-2.361[b]	2.764[b]	-2.994[c]
Δspain	Δgermany		3.275[c]		5.200[c]	
Δgermany	Δspain	ec_{-1}	2.244[b]	-2.361[b]	3.826[c]	-2.994[c]

[a], [b], and [c] respectively are statistically significant at the 10%, 5% and 1% levels.

Note: The F-value is used to test H_0: $\gamma_1 = \gamma_2 = \ldots = \gamma_9 = 0$
The t-value is used to test H_0: $\lambda \geq 0$

4. Summary And Conclusion

This paper used weekly MSCI price indexes from Datastream to verify the robustness of Hardouvelis, Malliaropulos and Priestley's (2006) conclusion of full integration of the European stock markets during the 1990s. The degree of market integration of the three stages of the currency union is evaluated using the pre-1990, the 1990s, and the 2000s sample periods. For completeness, we further evaluate market integration for the post-1980s period and the full sample period. Results of this study indicate that the three different stages of the currency union – pre-anticipated union, fully anticipated union based upon Hardouvelis, Malliaropulos and Priestley's (2006) study, and post-union periods – show extremely few bidirectional causations from the 1990s, the 2000s and the post-1980s sample periods. This finding led us to believe that the EU stock markets did not achieve full integration during the 1990s and onward. The strength of both short-run and long-run causal relations actually fell during the 1990s and the 2000s compared to their counterparts during the pre-1990s. Our findings thus do not support Hardouvelis, Malliaropulos and Priestley's (2006) conclusion of full integration of the EU stock markets during the 1990s and onward.

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