Continental Shift? An Analysis of Convergence Trends in European Real Estate Equities

Authors

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Abstract

This article is the winner of the International Real Estate Investment/Portfolio Management category (sponsored by LaSalle Investment Management) presented at the 2002 American Real Estate Society Annual Meeting.

This study investigates the effects of European monetary integration on the behavior of stock returns in European real estate companies from the perspective of a dollar-denominated investor. A range of statistical tests is applied to assess changes in segmentation, co-movement and causality. The results suggest that, relative to the wider equity markets, the dispersion of performance is higher, correlations are lower and a common contemporaneous factor has much lower explanatory power whilst lead-lag relationships are stronger. Less and slower integration is attributed to the relatively small size of the real estate securities market and the local nature of many real estate companies' portfolios.

Introduction

By 2002, twelve of the European Union's (EU) fifteen members had joined a single currency area. Participants in EMU (European Monetary Union) adopted a common currency, monetary policy and also agreed to impose common criteria relating to fiscal policy. There is a growing body of evidence suggesting that European monetary integration has been associated with increasing co-movement in European equity markets.

This study investigates the extent to which the macro-economic shift represented by EMU has influenced the performance of publicly-traded commercial real estate investment returns. It seeks to identify the extent to which the monetary integration has reduced the importance of national factors relative to common, pan-European factors in determining real estate returns. Further, since there is growing evidence of increased integration in European general equity markets, this study also

compares the relative levels of integration between the real estate sector and general equities. Given the localized nature of real estate investment, it is hypothesized that property company returns will show less evidence of integration than more general aggregate equity market indices.

The remainder of the article is organized as follows. The next section examines existing research on the effects of economic integration on capital market and real estate performance. This is followed by a discussion of the data, methods and results of an empirical investigation of the effects of monetary integration on patterns of performance of European publicly-traded commercial real estate markets viewed from the perspective of an investor in the United States or a dollar-denominated investor. The final section concludes and identifies areas for further study.

European Monetary Integration and Capital Market Convergence

The transition to the introduction of a single currency in 1999 forced aspirant members to meet criteria on nominal convergence. Exhibits 1 and 2 illustrate how 1997 was the culmination of a notable reduction in variations in inflation and long-term interest rates (with exchange rate variability showing similar patterns) mostly due to the convergence of Spain, Portugal and Italy.

However, studies of patterns of national and regional economic convergence have shown that real convergence has not necessarily been a consequence of nominal convergence (see McCarthy, 2000; Baele and Vennet, 2001; and EC, 2001).

Exhibit 1 | Convergence in Bond Yields: 1991–2001

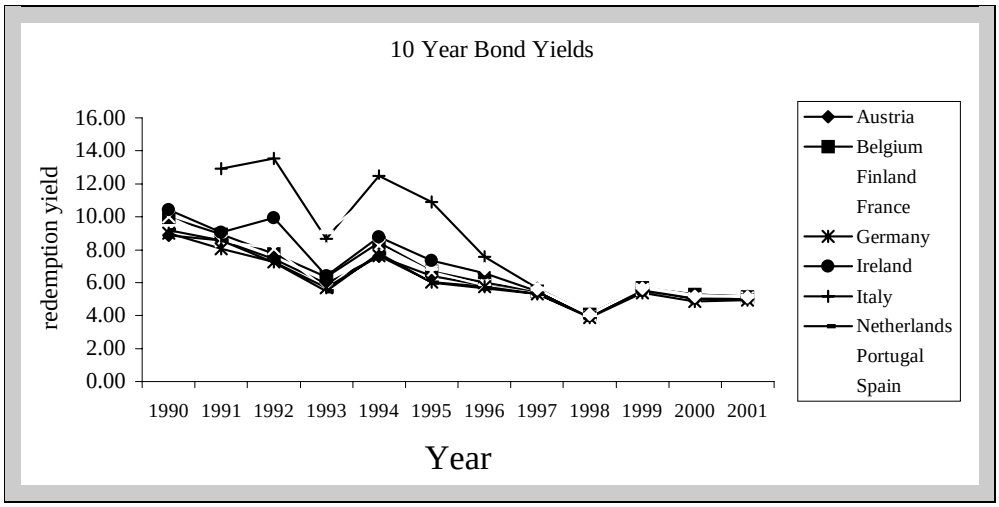
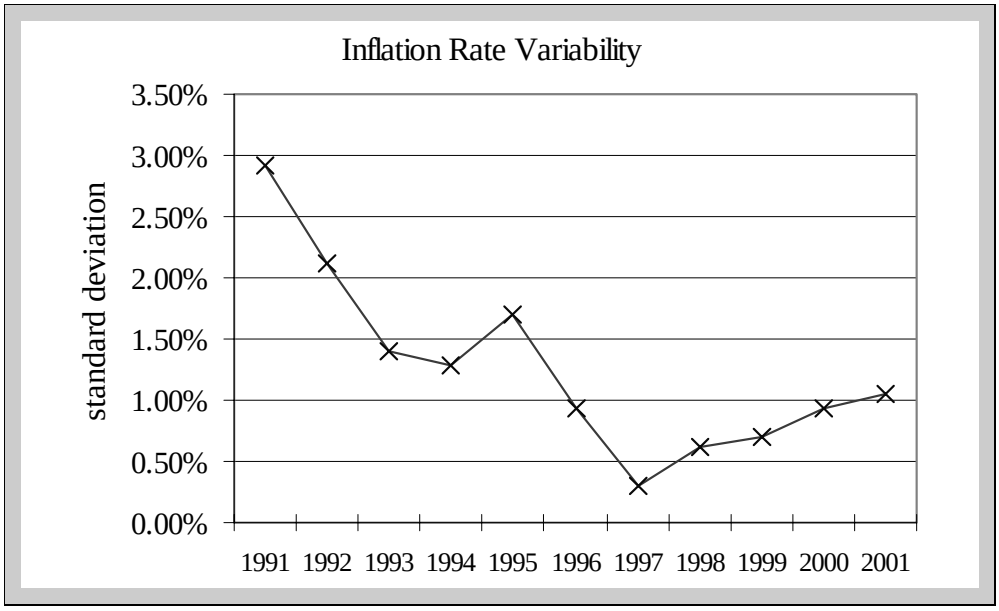


Exhibit 2 | Convergence in Inflation Rates: 1991–2001



Although not the subject of this article, the increase in the relative dispersion in national inflation rates since 1997 reflects the fact that the imposition of common monetary policies (input convergence) does not necessarily result in output convergence and, indeed, can produce divergence in macro-economic performance.

Studies of European capital market integration have customarily used data sets that precede the introduction of a single currency. Empirical results display some inconsistency. In terms of basic correlation between markets, studies report large increases since the 1980s. Freimann (1998:.40) finds that from ''from the mid-1970s until the end of 1996, the correlation between European stock markets has, on average, tripled—from 20% to more than 60%.'' This is consistent with Rouwenhorst (1999) who finds similar increases in correlation. More recently, in unpublished preliminary research, Baele and Vennet (2001) find significantly positive contemporaneous correlations between local excess returns and EU-15 returns ranging from 0.57 in Belgium to 0.88 in the United Kingdom. Moreover, these increases have been significantly higher than changes in correlation between non-European markets.

In order to overcome the limitations of basic correlation measures (that increasing country correlation may be due to increased correlation between sectors across countries), country and industry effects have been separated. Rouwenhorst (1999) reports that country effect still dominated sector effects in explaining return variability. However, similar studies[1] using more up-to-date data report that, since

1997, industry effects have overtaken country effects (see Baca, Garb and Weiss, 2000; and Cavaglia, Brightman and Akev, 2000). In related research, Chelley-Steeley and Steeley (1999) use a vector autoregressive (VAR) framework to examine the effects of the removal of exchange controls on European stock market integration. They find that domestic factors explain less of the variation in equity market returns after the removal of exchange controls.

It is clear that the period prior to the introduction of a single currency has seen increases in correlation. The literature suggests a number of direct effects of the introduction of EMU. The relative significance of the 'event' of EMU for national markets should be related to the degree to which it varied from European yardsticks in the past. The following effects may be witnessed.

- A consequence of the introduction of a single currency is that the currency matching rules no longer restrict investors to their national markets.[2]
- The elimination of exchange rate uncertainty within the Euro zone removes the costs of hedging.
- The convergence of risk-free rates produces increased homogeneity in the valuation of equities.
- Increased homogeneity will be further enhanced if the convergence hypothesis holds and results in a reduction in country effects on corporate dividend payments.
- The convergence of risk-free rates also results in a cancellation of assets as government issued bonds become effectively interchangeable.

Further, Beltratti (1999) argues that effects on variance on the business cycle may not be uniform. There is a relatively clear divide between 'southern' economies such as Spain, Portugal and Italy that have in the past two decades experienced higher than (EU) average volatility in bond yields, inflation, exchange rates and GDP growth and 'northern' economies that have essentially 'tracked' the German economy. Applying Markowitz optimization to stock and bond investment, Beltratti concludes that the effects of increased co-variances produced by monetary integration are likely to be outweighed by reduced volatilities and that, consequently, the impacts on the diversification potential of monetary integration will be minimal.

Is Real Estate Different?

The extent to which the investment characteristics of the public real estate sector differ from other mainstream sectors is a pertinent issue. Although commentators emphasize the lack of portability of property as an asset class, it is clearly rooted in global economic factors both through occupational demand and by capital market effects. Nevertheless, there are a number of potential sources of

segmentation. Issues such as limited free float, low liquidity and poor accounting transparency are commonly cited problems associated with public real estate markets in a number of EU markets. Further sources of segmentation may be relative differences in internationalization. Most major economic sectors within the EU have experienced a significant degree of global and/or pan-European consolidation in the last decade. Dermeier and Solnik (2001) find evidence that the influence of international factors on returns is positively linked to the level of international business that the company performs.

To confirm anecdotal evidence suggesting that European property companies have mainly domestic portfolios, the portfolios of 155 real estate companies in thirteen countries were examined based on information in the *GPR Handbook of European Property Companies* (GPR, 1998). Twenty-seven percent of those companies had portfolios that were *local* in nature (that is, were based in a single city or region); a further 49% had 100% domestic portfolios. Nine percent had some international holdings as a minor part of their portfolio. Only 15% were truly international in nature. Over a third of those international firms were German open-ended funds. Excluding these, just over 10% of the European real estate companies were diversified across countries and 80% had no non-domestic holdings.

Much of the research on international real estate investment has focused on the question of whether the theoretical portfolio gains from investing across national boundaries apply to property markets, particularly when currency risk is considered. Since this study is concerned with real estate securities, just three papers are noted. Worzala and Bernasek (1996) considered the potential impact of European integration, concluding that the European project would reduce differences in performance across national markets. Goetzmann and Wachter (2000) used factor analysis on property returns in a number of global cities and detected a 'global' property factor implying a source of common variation. Lee & D'Arcy (1998) examined sector, local and national property market effects in Europe using an approach similar to that employed by Heston and Rouwenhorst (1994) and Beckers, Connor and Curds (1996). They suggest that there are strong country factors that dominate sector and city effects. They argue that European integration may have less impact on real estate because of structural and institutional differences.

A substantial body of work on securitized real estate has been produced by Eichholtz and co-workers using the GPR property indices employed in this study. Eichholtz (1996) produced evidence that suggested that international real estate stocks were better diversifiers than equities or bonds, suggesting that the correlation between national property markets are lower than for the other major asset classes. Eichholtz, Huisman, Koedick and Schuin (1998) test for the existence of 'continental' factors in real estate securities. They find evidence of a strong European effect with a significant continental factor, which appears to increase in strength from the early 1990s (that is, with the completion of the Single

European Market and a move toward Monetary Union). By contrast, they find little evidence of a significant Asian continental factor.

Brouen and Eichholtz (2001) note that the price reactions to property company equity and debt offerings vary markedly across European countries and attribute differences to real estate tax regimes. Eichholtz, Koedick and Schweitzer (2001) contrast property companies with a domestic focus with those that follow global investment strategies. Their results suggest that local oriented firms significantly outperform global firms once corrected for portfolio composition. The implication drawn is that real estate markets are intrinsically local in nature and that information asymmetry and information costs are major constraints to adopting a global strategy. Gordon and Canter (1999) also use GPR data to examine the correlation between national property and equity markets in relation to type of investment vehicle and the international nature of property companies. In some markets they find convergence in returns; in others, divergence.

Methods and Data

This study examines indices of publicly-traded property companies in Eurozone countries and compares their performance to the overall stock market behavior in those countries. The data analysis consists of four different approaches: correlations between returns, principal component analysis, Granger causality tests and VARs. The correlation between the country indices is examined first. Two analyses are performed. First, the cross-sectional average correlation is examined between countries in the period before and after lock-in of currencies, that is, pre-1997 and post-1997. The prior expectations, in general, are that the average correlation between countries will increase in the latter period and that cross-sectional standard deviations will fall. The correlation between the real estate series is also expected to be much lower than between the equity market series. Second, the average of rolling five year correlations for both equity and property series is examined. The expectation here is that, for both series, the correlations will increase with the adoption of the Euro.

Convergence and integration implies a single pan-European market factor. Principal components analysis was used to test the returns from the series, again for both pre-1997 and post-1997 periods. Evidence of integration would be provided by the existence of a single factor explaining a high proportion of the variation in the dataset, with the majority of countries showing high loadings on this factor. Prior expectations are that the influence of a pan-European factor will be greater in the post-1997 period and that it will be more evident in equity markets than in real estate markets. This common movement could be a *global* rather than a European equity or property market factor. However, the main focus is to explore differences between the behavior of real estate and general equities in response to monetary union.

In a fully integrated market, there should be no leading and lagging relationships with business cycles harmonized and arbitration preventing price discovery

anomalies. Granger causality was used to test this proposition for the equity and real estate series. For each pair of countries, one-way and two-way causality was conducted for the pre-1997 and post-1997 periods. The prior expectation is that evidence of causality—particularly one-way causality—will decline as European convergence associated with the monetary union increases. The equity series is expected to be more fully integrated and, hence, exhibit fewer lead-lag relationships. On the other hand, the apparent segmentation of real estate markets may reduce the incidence of Granger causality.

The linkages between markets are also investigated using a VAR analysis that models the market behavior as a system of related equations in which each variable (return in each country) is explained by past returns in its own and all other countries. The advantage of this approach is that it is possible to trace through the system, the effect of an unexpected shock in one country. The model permits an examination of a market effect that arises from a shock in each of the other markets over a specific number of periods. The result may represent an impulse function or a variance decomposition. If the markets become more closely integrated, then the impulse function will increase with respect to other countries and national factors will become less significant in explaining variation in returns. In a completely integrated market (such as might be observed in, say, the New York Stock Exchange), the effect will be evident almost immediately. In less liquid and more thinly traded markets, the effect will take longer to be transmitted but changes in the degree of integration should still be evident in the impulse functions. Again the prior expectations are that differences will emerge between real estate companies and overall equity indices.

Monthly return data was used for the analysis: using higher frequency data, while increasing the number of observations, is likely to introduce excess noise into the analysis. Since the effect of monetary union is examined fully hedged indices cannot be assumed without accounting for hedging costs, so all series were converted to provide U.S. dollar returns. Thus, the analysis is conducted from the perspective of a U.S. investor or an investor whose wealth portfolio is dollar denominated, and whose international investments are, in effect, unhedged.[3]

Equity market data were obtained from DataStream; however, there are known problems with the DataStream property market series. Two sources were available for property company data: Global Property Research (GPR) and the European Public Real Estate Association (EPRA), both of whom collect and analyze the stock market performance of publicly-listed real estate firms. Both kindly agreed to provide data. EPRA data ran from January 1990, while many of the GPR series ran from January 1984. This study used the GPR series to provide comparability with prior studies using this data source. Initial analysis reveals that many EPRA and GPR series have high correlations. However, there are some anomalies that require further analysis. The study used especially provided GPR series for Germany, the Netherlands and Austria that exclude open-ended funds to avoid distortions caused by non-market pricing. There may be some survivorship bias in the data series.

Results

In total, the study employed common stock and property company series for eight Eurozone countries: Austria, Belgium, France, Germany, Ireland, Italy, The Netherlands and Spain. Basic descriptive statistics for the series are shown in Appendix 1 (see Exhibits A1 and A2). Many of the series fail conventional tests of normality, largely as a result of high kurtosis—fat tails being characteristic of stock market series. While this does not affect the analysis conducted here, it needs to be borne in mind in conducting any subsequent capital market pricing analysis or modeling work. Note that, with the exception of Ireland, the real estate series have produced lower average returns than the corresponding equity market series, with no compensating reduction in risk. This reflects the long bull market run in global stock markets. In the post-1997 period, property company performance was superior to the overall stock market in all countries except The Netherlands and Spain.

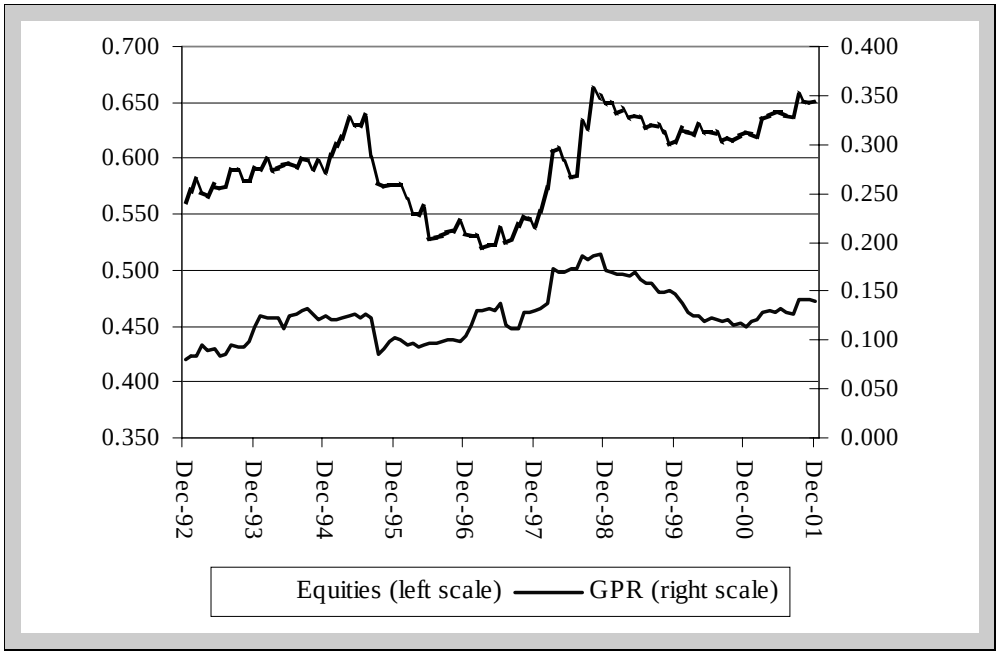
Exhibit 3 shows the average correlation of returns between the eight Eurozone countries analyzed for the equity and the GPR property indices. As can be seen, the average correlation for the equity indices is considerably higher than for the property indices, with the latter also exhibiting greater variance. This supports the idea that real estate markets are less integrated than the wider equity markets in Europe. The equity market correlation increases markedly in the post-1997 period, with the difference significant at the 0.01 level, and there is a slight reduction in volatility. The average correlation also increases for the property series, although the result is not statistically significant.

Exhibit 4 shows rolling five year average correlations for both equity and property series. For the equities, the average correlation declines in the first half of the 1990s then climbs sharply following the decision to implement the single currency and the locking in of convergence criteria in 1997. Average correlations in the property indices actually decline from their peak in 1994–1998: this may reflect the differing exposure of national stock markets to the TMT boom-bust cycle and,

Exhibit 3 | Return Correlation, Eight Eurozone Countries

	Equities		GPR	
	Mean	Std. Dev.	Mean	Std. Dev.
Full Period	0.590	0.117	0.125	0.224
Pre-1997	0.557	0.137	0.100	0.253
Post-1997	0.652	0.120	0.140	0.247

Exhibit 4 | Five Year Rolling Correlation, Eurozone Mean



hence, attitudes to value sectors such as real estate. The differences in the cycle, allied to an overall reduction in returns, mask any convergence in return levels across markets in the post-1997 period. The cross-sectional coefficient of variation increases for the equity indices in the later period as mean returns fall from 1.6% to 0.6%; for the property indices, an increase in returns is offset by an increase in cross-sectional volatility.

To see if it were possible to detect a common single factor affecting performance, a series of factor analyses was performed. For both equity and property series, principal components analysis was used to decompose the variance; components with eigenvalues greater than one were retained and then rotated using the varimax procedure in an attempt to improve the interpretability of the factors. Separate analyses were run for the pre-1997 and post-1997 periods and for the full sample. The presence of a single large factor explaining much of the variation in the data would be evidence of common patterns of movement. Full results are shown in Appendix 2.

In all three analyses of the equity indices, a single factor explained a high proportion of the variance in the data. For the pre-1997 period, the first component had an eigenvalue of nearly five and explained some 62% of variance. All eight countries had loadings in excess of 0.6 (the lowest being Austria and Italy).

In the post-1997 period, the explanatory power of the principal component had increased further, with an eigenvalue of 5.6, explaining 70% of the data variance. All countries had loadings of 0.7 or higher on this single factor. Thus, there is strong evidence of a common European stock factor, which strengthens in the post-Euro period.

The analyses of the GPR real estate series produce a much less clear picture. In the pre-1997 period, three components have eigenvalues greater than one. The largest explains less than a third of the variation in the data; the second explains around 21% of the variation and the third accounts for a further 14%. The factors are not easy to interpret. The first factor has strong positive loadings for France, Germany and Ireland, a weaker loading for Spain and a negative loading on Austria. The second has higher positive loadings on Italy, Netherlands and Spain, the third has higher loadings on Austria and Belgium.[4]

The post-1997 analysis produces near identical results: two factors have eigenvalues greater than unity, with the third, at 0.97, falling just below the extraction cut-off. The three factors explain 31%, 25% and 12% of the variation, respectively. The factor loadings for the first two factors are very similar to those of the pre-1997 analysis; the only major changes being that Belgium has a high loading on the second factor and Spain has a low loading on the first factor. The full period analysis is very similar to the post-1997 analysis. It is, thus, not possible to conclude that there is a strong common factor operating in the Eurozone public real estate markets.

Exhibit 5 summarizes the results of the Granger causality tests for lead and lag relationships. The tests were carried out using a twelve period lag window. The results including and excluding relationships are significant to the 0.10

Exhibit 5 | Granger Causality: Evidence of Lead and Lag Relationships

	Including 0.10 Sig.		Excluding 0.10 Sig.	
	Equity (%)	Property (%)	Equity (%)	Property (%)
Panel A: Pre-1997				
None	64.3	71.4	89.3	78.6
One Way	32.1	25.0	10.7	21.4
Two Way	3.6	3.6	0.0	0.0
Panel B: Post-1997				
None	67.9	78.6	92.9	96.4
One Way	32.1	21.4	7.1	3.6
Two Way	0.0	0.0	0.0	0.0

significance level (given the relatively small observation period, it may be worthwhile to consider weakly significant results). For both equity and real estate series, the number of causal relationships falls in the post-1997 period: the change is more pronounced for the property company data. As is often the case with Granger causality tests, the results are unstable and dependent on the lags included in analysis. However, the decline in lead-lag relationships does seem consistent, providing weak evidence of convergence in these markets in the Euro period.

Another method of revealing inter-country relationships of returns is through the VAR approach. VARs were estimated over the sub-periods 1984–1996 and 1997–2002; the optimal lag length was selected using the Hannan-Quinn, Final Prediction Error and Schwarz criteria. For the equity indices, the appropriate lag was one, while for the GPR series, it was taken as six. In the latter case, the shortage of the time period post-1997 constrained the lag length, which might otherwise have been longer than six months.

Given the VAR, the relationship between the returns from each country can be explored by means of impulse-response functions. With eight series, the patterns of influence are not at all clear. Appendix 3, Exhibits A10 and A11 show two examples: the impact of property market shocks on the French and German markets for the sub-period 1984:1 to 1996:12. An alternative, and preferred,

Exhibit 6 | Variance Decomposition Analysis: Equities

Explaining	Netherlands	Germany	Italy	France	Belgium	Spain	Ireland	Austria
Netherlands	95.9	2.8	0.0	0.7	0.0	0.1	0.3	0.2
	64.4	0.8	**2.8**	**1.0**	**7.1**	**17.6**	**0.8**	**5.4**
Germany	68.1	25.0	0.5	0.9	0.4	0.5	3.0	1.6
	46.8	**21.3**	**1.9**	**2.0**	**5.8**	**17.4**	0.0	**4.6**
Italy	22.8	3.9	68.7	1.0	0.3	0.1	3.1	0.1
	35.4	**8.5**	**30.7**	0.1	**3.3**	**13.5**	2.0	**6.5**
France	51.3	5.1	0.2	39.1	0.7	0.6	1.6	1.4
	39.8	**9.7**	**7.0**	**16.9**	**5.3**	**14.7**	1.0	**5.7**
Belgium	66.8	2.7	1.0	3.0	24.6	0.0	1.3	0.7
	39.0	1.6	**4.5**	2.0	40.1	**5.5**	**4.6**	**2.8**
Spain	55.7	3.1	4.3	0.1	4.4	31.5	0.1	0.8
	36.8	**10.2**	**6.1**	0.4	1.4	37.2	**2.7**	**5.2**
Ireland	68.4	0.8	1.1	0.2	3.3	1.3	24.8	0.1
	18.9	0.2	**11.0**	**8.0**	2.0	**16.0**	39.2	**4.6**
Austria	27.7	15.1	0.3	0.6	2.0	0.6	6.6	47.2
	31.0	0.2	**1.7**	**13.6**	**5.2**	**13.6**	**7.3**	**27.5**

Notes: Figures are percentages. For each country, the first row is pre-1997, the second row is post-1997. Figures in bold are consistent with the hypothesis of increasing integration.

insight can be gained by examining the variance decompositions. Of course, one recognized problem with VAR analysis is that the results of variance decomposition are influenced by the order of the decomposition.

This study follows Chelley-Steeley and Steeley (1999) by ordering the series after analyzing the first and higher order cross correlations over the whole period. The VAR has then been ordered according to which equity markets leads others. Chelley-Steeley and Steeley found in their examination of European equity markets that this ordering accorded closely with the market capitalizations of the equity markets. However, this is not found to be the case in this study. Nevertheless, as pointed out by Chelley-Steeley and Steeley, the ordering issue is less of an issue in this application because it is not concerned with the absolute ordering of the variance decomposition but the change from one sub-period to another.

Exhibits 6 and 7 compare the percentage of the variation in each national equity and property market attributable to changes in their own and the other seven markets. The illustrations show the proportionate effects after three months of innovations in one market, which explains the variation in each market, whereas the cut-off period in the property market was chosen to be six months in the light of the stronger serial correlation in property returns. In Exhibit 6, for example, in

Exhibit 7 | Variance Decomposition Analysis:Real Estate Companies

Explaining	Germany	Ireland	Austria	Italy	Belgium	Netherlands	Spain	France
Germany	45.5	4.5	6.5	5.9	26.8	4.4	3.1	3.2
	29.6	**8.5**	**17.0**	**9.2**	3.8	**18.0**	**4.7**	**9.2**
Ireland	10.0	4.6	14.7	7.2	11.9	48.9	2.1	0.6
	4.9	77.9	3.4	3.3	4.2	4.3	0.9	**1.0**
Austria	4.7	3.8	41.9	1.0	10.5	31.5	3.7	2.8
	2.9	**14.1**	62.0	**5.6**	1.4	0.7	**4.7**	**8.6**
Italy	40.8	2.7	9.1	20.4	8.2	14.6	2.9	1.2
	28.5	**44.2**	1.4	**19.5**	2.3	1.9	1.6	0.6
Belgium	5.8	4.1	3.9	7.7	34.5	37.4	3.8	2.7
	20.2	**4.8**	**18.4**	6.1	39.8	1.3	2.9	**6.5**
Netherlands	7.6	2.5	23.9	6.0	2.6	56.4	0.7	0.2
	3.1	**52.8**	15.7	1.2	**9.3**	**10.3**	**1.6**	**5.9**
Spain	12.1	5.3	12.4	4.5	6.9	52.0	4.5	2.3
	8.9	**33.9**	**24.0**	**7.6**	3.0	8.3	7.1	**7.1**
France	12.1	4.3	20.8	9.0	6.2	45.1	1.4	1.2
	10.6	**58.5**	3.8	**13.2**	3.1	2.0	**3.8**	5.0

Notes: Figures are percentages. For each country, the first row is pre-1997, the second row is post-1997. Figures in bold are consistent with the hypothesis of increasing integration.

the case of the Netherlands equity market, before 1997, 96% of the variance was self-induced while in the later period the proportion of variation explained by the domestic market fell to 64%.

Convergence after the 1984–1996 period would be reflected in an *increased* contribution from other markets and a *reduced* contribution from the domestic market. The figures in the cells in Exhibits 6 and 7 that are printed in bold type are consistent with the hypothesis. As can be seen, the effect is more clearly revealed in the equities market than in the property market. Of the sixty-four numbers in each table, forty-four of the entries (69%) in the equities case are consistent with greater integration whereas, in the case of the property markets, only thirty entries (47%) would be consistent with the hypothesis of greater integration. This lack of change exhibited in the VAR analysis is consistent with the results of the other methods used in the study.

Conclusion

Previous research on European stock market integration suggests that the last two decades have seen reductions in segmentation. There have been significant increases in market correlations and more recent research suggests that sector effects have begun to overtake country effects in explaining company returns. Increasing integration is further confirmed as stock markets are shown to respond to shocks in other European stock markets. However, integration has been less notable in indirect real estate markets.

The most clear-cut finding of this study is that commercial real estate equity markets are much less integrated than wider equity markets. Relative to the wider equity markets, the dispersion of performance is higher, correlations are lower and a common contemporaneous factor has much lower explanatory power while lead-lag relationships are stronger. As a result, the evidence of the transmission of monetary integration to real estate securities is less noticeable than to general securities. Less and slower integration is attributed mainly to the size of the real estate securities market and the national (and often local) nature of the majority of the companies' portfolios.

In terms of further research, a limitation of this study is the focus on European data *per se*. In order to assess whether the changes identified have been caused by, rather than simply being associated with European monetary integration, it is necessary to incorporate the effects of global integration. In particular, it would be useful to assess whether the U.S. or non-EMU markets display similar changes in correlation, causality and impulse response. In addition, dealing with aggregate data may be disguising interesting national variations in the effects of monetary integration. Evidence at the macro-economic level would imply that these exist. This research has also alluded to the diversity in portfolio composition of individual real estate companies. Analysis of variations in performance between domestic investors and non-domestic investors would provide further insights into the influence of European integration.

Appendix One

Descriptive Statistics

Exhibit A1 | GPR Property Series

	Austria	Belgium	France	Germany	Ireland	Italy	Netherlands	Spain
Mean (%)	0.41	0.58	0.74	0.53	1.79	0.98	0.45	0.91
Max. (%)	21.13	27.65	16.09	39.56	56.42	35.31	11.93	36.18
Min. (%)	−14.65	−14.73	−14.71	−20.43	−31.84	−16.14	−15.69	−12.18
Std. Dev. (%)	5.47	5.54	4.89	6.68	11.84	7.71	3.95	9.24
Skewness	0.615	0.653	−0.019	1.307	0.577	0.962	−0.346	0.967
Kurtosis	6.051	5.850	3.499	9.583	5.675	5.535	4.180	5.695
Jarque-Bera	0.518	73.32	2.25	399.25	67.57	91.16	14.87	81.16
Probability	0.372	0.000	0.324	0.000	0.000	0.000	0.001	0.000

Notes: Number of observations: Austria = 125; Belgium = 179; France = 216; Germany = 191; Ireland = 191; Italy = 216; Netherlands = 191; and Spain = 177.

Exhibit A2 | DataStream Equity Series

	Austria	Belgium	France	Germany	Ireland	Italy	Netherlands	Spain
Mean (%)	1.32	1.30	1.51	1.08	1.74	1.42	1.33	1.01
Max. (%)	42.41	24.11	19.38	17.81	27.00	27.76	13.60	22.49
Min. (%)	−19.48	−18.96	−15.50	−17.74	−25.32	−15.47	−17.95	−18.32
Std. Dev. (%)	7.86	5.23	6.09	5.71	6.77	7.17	4.63	6.17
Skewness	0.903	0.093	0.008	−0.240	−0.071	0.612	−0.459	−0.080
Kurtosis	6.832	5.453	3.204	3.753	5.048	3.636	4.304	3.825
Jarque-Bera	161.50	54.46	0.38	7.18	37.93	17.10	22.89	5.23
Probability	0.000	0.000	0.827	0.028	0.000	0.000	0.000	0.073

Notes: There are 216 observations in each series except that for Spain, which has 178.

Exhibit A3 | Mean Monthly Returns by Time Period

	Austria (%)	Belgium (%)	France (%)	Germany (%)	Ireland (%)	Italy (%)	Netherlands (%)	Spain (%)
Panel A: GPR								
Pre 97	0.49	0.18	0.40	1.39	1.51	0.73	0.64	1.14
Post 97	0.33	1.35	1.60	2.37	2.41	1.63	0.03	0.47
Full	0.41	0.58	0.74	1.70	1.79	0.98	0.45	0.91
Panel B: Equity								
Pre 97	1.91	1.61	1.72	1.31	2.02	1.57	1.60	1.14
Post 97	−0.20	0.47	0.97	0.49	1.01	1.06	0.60	0.74
Full	1.32	1.30	1.51	1.08	1.74	1.42	1.33	1.01

Appendix Two

Factor Analyses

Exhibit A4 | Equity Indices—Variance Explained

	Pre 1997		Post 1997		Full Period	
Component	Eigenvalue	% Variation	Eigenvalue	% Variation	Eigenvalue	% Variation
1	4.968	62.1	5.588	69.9	5.173	64.7
2	0.793	9.9	0.772	9.7	0.694	8.7
3	0.691	8.6	0.543	6.8	0.641	8.0
4	0.534	6.7	0.345	4.3	0.475	5.9
5	0.409	5.1	0.320	4.0	0.377	4.7

Exhibit A5 | Factor Loadings (Single Factor)

	Pre 1997	Post 1997	Full Period
Austria	.611	.746	.653
Belgium	.868	.791	.834
France	.821	.906	.855
Germany	.902	.895	.901
Ireland	.770	.709	.742
Italy	.633	.811	.706
Netherlands	.883	.935	.901
Spain	.762	.866	.805

Exhibit A6 | GPR Property Indices—Variation Explained

	Pre 1997		Post 1997		Full Period	
Component	Eigenvalue	% Variation	Eigenvalue	% Variation	Eigenvalue	% Variation
1	2.537	31.7	2.497	31.2	2.417	30.2
2	1.688	21.1	1.982	24.8	1.797	22.5
3	1.134	14.2	0.970	12.1	0.927	11.6
4	0.833	10.4	0.802	10.0	0.817	10.2
5	0.619	7.7	0.561	7.0	0.633	7.9

Exhibit A7 | Factor Loadings, Pre 1997

	Factor 1	Factor 2	Factor 3
Austria	−0.602	0.341	0.516
Belgium	0.197	−0.004	0.858
France	0.828	−0.005	0.280
Germany	0.767	−0.004	0.108
Ireland	0.691	−0.207	−0.005
Italy	0.001	0.699	−0.318
Netherlands	−0.331	0.698	0.195
Spain	0.463	0.659	0.263

Exhibit A8 | Factor Loadings, Post-1997

	Factor 1	Factor 2
Austria	−0.625	0.341
Belgium	−0.001	0.690
France	0.842	0.009
Germany	0.794	0.001
Ireland	0.778	0.198
Italy	0.314	0.607
Netherlands	−0.168	0.703
Spain	0.005	0.716

Exhibit A9 | Factor Loadings, Full Sample

	Factor 1	Factor 2
Austria	−0.644	0.403
Belgium	0.009	0.572
France	0.804	0.243
Germany	0.785	0.002
Ireland	0.713	0.189
Italy	0.119	0.555
Netherlands	−0.367	0.638
Spain	0.188	0.729

Exhibit A10 | Response of French Property Markets to a 1 Std. Dev. Impulse from Other Markets

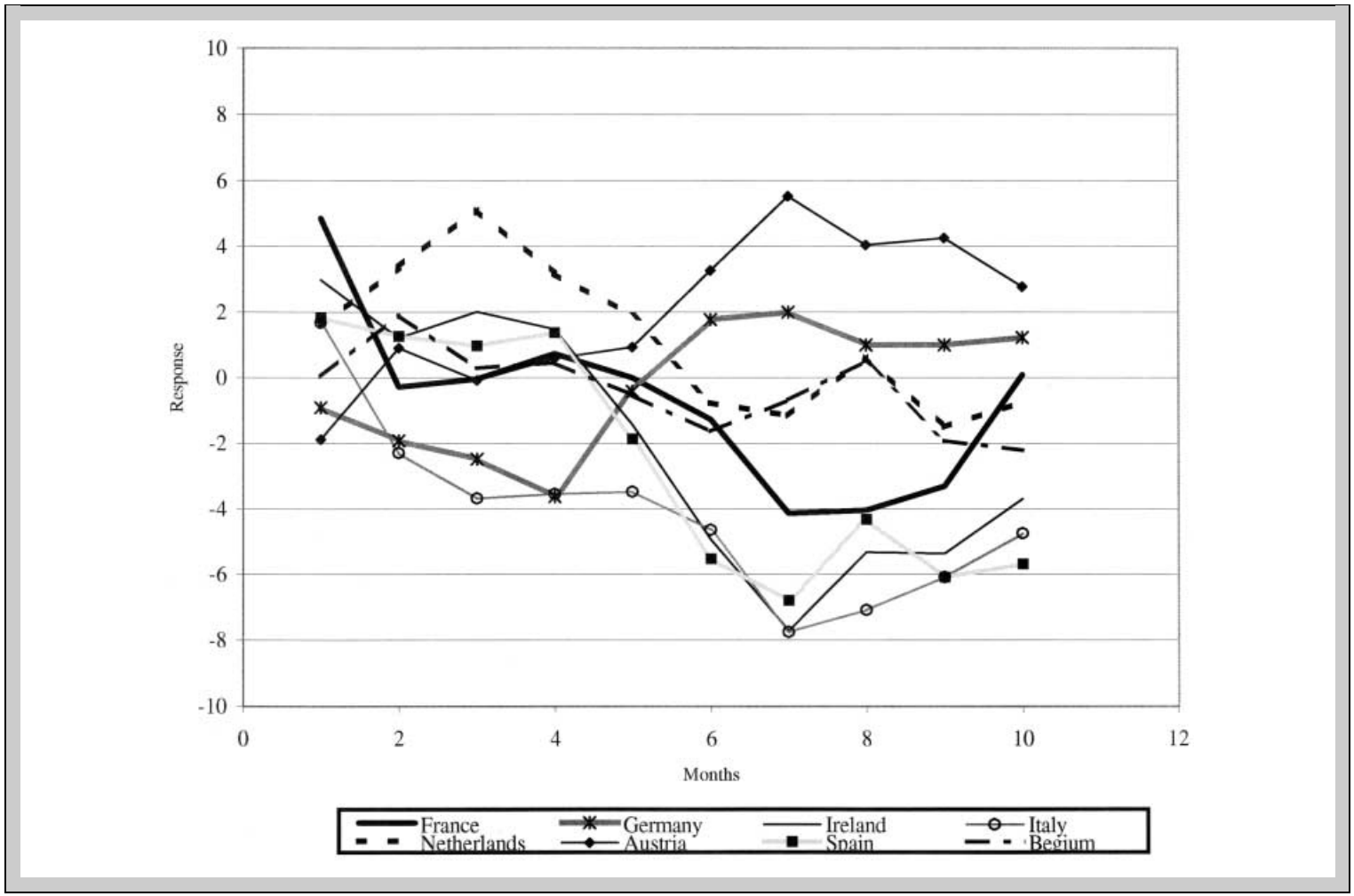
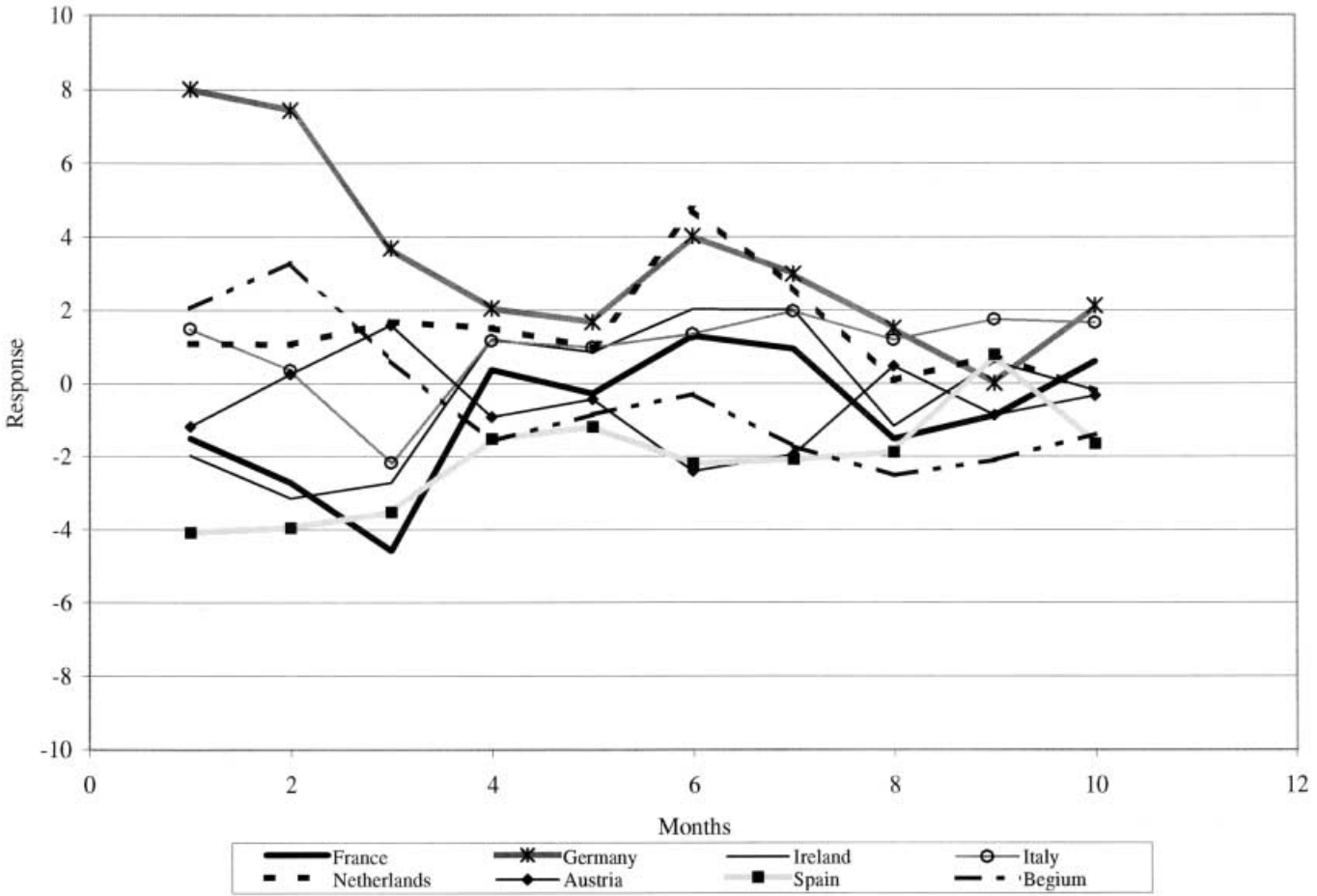


Exhibit A11 | Response of German Property Markets to a 1 Std. Dev. Impulse from Other Markets



Endnotes

[1] These studies do not isolate European markets. They include non-EMU European markets, U.S., Japan and Australia.

[2] The restrictions on equity investments are still in place and, outside the countries referred to, a 'bond bias' is still generally apparent in EU investing institutions. An objective of the European Commission is to achieve a 'prudent man' model of regulation for EU investing institutions and an associated increase in allocation to equities.

[3] While using dollar denominated returns is a standard approach in the international literature, the conversion to dollars raises the possibility that apparent increases in market integration result from the coordination of U.S. dollar-Euro movements by comparison to movements of the separate currencies. Chelley-Steeley and Steeley (1999) use dollar denominated returns but report that there was little difference in results when home-country denominated returns were used. Myer, Chauhry and Webb (1997) argue that exchange-rate adjusted returns provide stronger evidence of structural change but found that in three of four cases that there were no differences in Johansen test results for cointegration between nominal, real or exchange-rate adjusted series. Similarly, Eichholtz, Huisman, Koedick and Schuin (1998) report no difference between U.S. dollar and local currency results in their investigation of continental factors in real estate returns. This study's preliminary analysis showed that the mean correlation between Eurozone countries exchange movements against the dollar in the pre-1997 period was 0.90. Sample analyses suggested that there was minimal difference between dollar-denominated and local currency results. Furthermore, since the study's primary purpose was to examine the difference in behavior and integration between real estate and general equity series, the currency conversion should not affect the generality of results.

[4] The factor analytic literature suggests that the final component extracted tends to act as a ''clean up'' factor, making interpretation of loadings problematic.

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