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Monetary integration and real estate markets: An investigation of the impact of the introduction of a single currency on real estate performance

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Abstract

This paper assesses the impact of the monetary integration on different types of stock returns in Europe. In order to isolate European factors, the impact of global equity integration and small cap factors are investigated. European countries are sub-divided according to the process of monetary convergence. Analysis shows that national equity indices are strongly influenced by global market movements, with a European stock factor providing additional explanatory power. The global and European factors explain small cap and real estate stocks much less well –suggesting an increased importance of 'local' drivers. For real estate, there are notable differences between core and non-core countries. Core European countries exhibit convergence – a convergence to a European rather than a global factor. The non-core countries do not seem to exhibit common trends or movements. For the non-core countries, monetary integration has been associated with increased dispersion of returns, lower correlation and lower explanatory power of a European factor. It is concluded that this may be explained by divergence in underlying macro-economic drivers between core and non-core countries in the post-Euro period.

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1. Introduction

The introduction of a new currency for most European countries on 1 January 2002 was the culmination of a far from smooth progression towards monetary integration over the previous two decades. Following over a decade of pegging arrangements, a timetable for the introduction of a single currency was introduced in 1991. The transition to EMU (European Monetary Union) in the period 1992-1999 was to have variable implications for the monetary and fiscal policies of aspirant members. This paper investigates the effects of this change in monetary regime on the performance of European real estate securities. This study builds on previous work by Lizieri *et al*. (2003) which examined the changes in the behaviour of European common and real estate stocks in the period 1993-2001. The contribution of this paper is that it investigates the contribution of global integration relative to European integration and takes into account the possibility that segmentation in real estate securities may be due to the small capitalisation of many real estate companies. Finally we also address the different *a priori* expectations for different groups of economies.

The remainder of the paper is organized as follows. The next section examines existing research on the effects of economic integration on capital market and real estate performance. This includes a discussion of the variable timing of monetary integration for different groups of European countries. 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, general equity markets and the small cap stock sector. The final section concludes and identifies areas for further study.

2. Background

Studies of European equities, even those pre-dating the introduction of the single currency, have found strong evidence integration of equity markets since the 1980s. Both Freimann (1998) and Rouwenhorst (1999) found increases in average correlation between national markets from approximately 0.2 in the 1980s to 0.6 in the 1990s. In more recent research, Baele and Vennet (2001) found significantly positive contemporaneous correlations between local excess returns and EU-15 returns ranging from 0.57 in Belgium to 0.88 in the UK. Further, these increases between European markets were significantly higher than changes in correlation between non-European markets. For the major equity markets, there is evidence of reducing country effects relative to sector effects. Since 1997, researchers have found that industry effects have overtaken country effects (see Baca *et al*, 2000 and Cavaglia *et al*, 2000). However, recent research has questioned the methodological basis of the country/industry research and the validity of the empirical conclusions

Adjaouté and Danthine (2002) identify clear evidence of convergence up to 1992. However, they find that the convergence of risk free rates in the late 1990s leaves no trace on equity returns. They speculate that this is probably due to the fact that equity premia are larger and more volatile than government bonds and that changes in equity premia make it difficult to identify structural changes in the period following the introduction of the Euro. Indeed, they report large increases in dispersion of returns in 2000-1 indicating that the post-Euro period has been very favourable for diversification within the Euro area.

It should be noted that it does not follow that European real estate securities will display similar patterns to general equities. Studies of integration of real estate securities have found that they tend to display notably different behaviour than common stocks. A number of stylized facts have emerged. Eichholtz (1996) found that the correlation between national property markets were lower than for the other major asset classes. Lizieri *et al.* (2003) also found that national real estate markets were much more

segmented than common stocks in that correlation were substantially lower and that loadings on a common factor were less. Hamelink and Hoesli (2002), in a study of 21 countries, found similar behaviour in the correlation. There is also strong evidence to suggest that real estate has become increasingly less strongly sensitive to common stocks. Both Ling and Naranjo (2002) and Bond *et al*. (2002) report a falling beta for real estate securities in the 1990s.

Focussing implicitly on global integration, there have been a number of recent studies examining the relative contribution of systematic relative to country specific factors in the explaining the behaviour of national real estate security markets and individual real estate company returns. Ling and Naranjo (2002) used a simple two factor model to measure the relative contribution of a world wide factor and country factors in company real estate returns across a range of international markets. They found evidence of a strong worldwide factor but that the country specific factor was significant in over 90% of cases[1]. Interestingly, when they divided the data set into two sub-periods (1984-89 and 1990-99), they find only a slight increase in country real estate sensitivity to world market movements. Bond *et al.* (2002) built on the work of Ling and Naranjo (2002) by incorporating country value factors. In the period 1900-2001, in common with Ling and Naranjo (2002), they found that the co-efficient of the global market factor was positive and significantly different from zero (except for Germany). However, they also reported that the portion of the variation in individual country excess returns explained by the global market was low. It is interesting to note that they found that for France and Netherlands, that the country specific factor was not significant. This is in contrast to all the other European countries (except Germany) including Belgium, Italy, Spain, Sweden and the UK. Looking at 21 countries in the period 1990-2002, Hamelink and Hoesli (2002) calculated the "pure" effects of various factors on international real estate security returns. The most relevant factors in this context were a common factor affecting all real estate securities and a country of origin factor. When the common factor was extracted, they unsurprisingly found that correlation were lower for pure country returns. However,

[11] One recurring exception is Germany where we believe there may be data limitations due to the presence and significance of open-ended funds.

an interesting finding in this context is that (for the 10 largest markets) average rolling correlation coefficients were stable during the period 1990 2002. In the period mid-1996 to mid-1998 there was a notable drop in rolling average correlation. This probably reflects the increase in currency volatility in the period 1992-1995.

Eichholtz *et al.* (1998) tested for the existence of "continental" factors in real estate securities. They found evidence of a strong European effect with a significant continental factor which appeared to increase in strength from the early 1990s with the completion of the Single European Market and move toward Monetary Union. By contrast, they found little evidence of a significant Asian continental factor. In private markets, confirming earlier work by Case et al (1999), 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. However, they found that country effects explained more of the variation in real estate returns than the global factor. In the real estate sector, drawing upon the approach first employed by Heston and Rouwenhorst (1994) and Beckers *et al.* (1996), Lee & D'Arcy (1998) examined sector, local and national property market effects in Europe. They found that there were strong country factors that dominated city and sector effects. Recent research by Grissom and Lizieri (2003) applied a range of statistical tests to identify structural breaks in the performance of real estate securities in the period 1989-2003. In the Eurozone, their findings are consistent previous work on general equities. They report the major temporal segmentation is observed between the periods 1989-92 and later periods. Whilst finding evidence of increasing integration in the Eurozone relative to non-European markets and non-Euro European markets, they also report that Germany, Ireland and Netherlands tend to produce results contrary to an integration hypothesis.

3. Data and Research Methods

European real estate securities have characteristics that generate expectations about the degree of integration relative to common stocks. A source of segmentation may be relative differences in internationalisation. Lizieri *et al.* (2003) found that most European real estate companies had mainly domestic portfolios. Excluding German open ended funds, just over 10% of the European real estate companies were diversified across countries whilst 80% had no non-domestic holdings. Since Dermeier and Solnik (2001) found that the influence of international factors on returns was positively linked to level of international business that the company performs, this home country bias might reduce the significance of common factors. Also, the small size of many European real estate companies may mean that they behave more like the 'small cap' sector. A lack of integration may be due to the relatively small market capitalization of the sector rather than any inherent 'localness' of real estate assets. Consequently we compare real estate return behaviour with the 'small cap' sector as well as common stocks.

Whilst there are a number of clear consequences for European institutional investors of the single currency relating in particular to reductions in the implications of currency matching rules, the elimination of exchange rate uncertainty, cancellation of assets and the convergence of risk free rates (and target rates of return). The implications of these consequences are not necessarily uniform across countries in terms of timing and degree. The degree of nominal convergence required to join the single currency varied between countries. The relative significance of the 'event' of EMU for a national economy can be related to the degree to which its performance varied from Core European yardsticks.

A number of countries had to significantly change their monetary and fiscal policy 'behaviour' in order to join the single currency whilst for others there were relatively insignificant implications for macro-economic policy. In particular, a group of countries around Germany,- Netherlands, Belgium, Austria, France and, to a lesser extent, Finland had aligned themselves closely to German monetary and exchange rate policy in the 1980s and 1990s. Hereinafter, we call these the "Core" group of countries. A group of 'southern' economies (Spain, Italy, Portugal and Ireland), tended to have greater

volatility in macro-economic variables. It is in these four countries, the non-Core group, that we should expect to see significant impacts of monetary integration. In contrast, Sweden and the UK remained outside the single currency zone and were not part of the monetary integration process. Denmark also remained outside the single currency zone but has continued to 'shadow' Eurozone monetary policy.

Using short term interest rates as a portmanteau variable to capture variation in economic variables such as inflation, exchange rate volatility and economic growth, Exhibits 1 & 2 illustrate both the major differences in the degree of nominal convergence prior to January 1999 and in its timing. In essence, January 1999 was a 'real' monetary event for the 'southern' economies whilst it had limited effects for the Core countries who had converged in early 1996. Changes in short term real interest rates also suggest that EMU had divergent effects on economic performance. The non-Core group received a significant monetary stimulus due to substantial reductions in real interest rates relative to other EMU members (Exhibit 3). However Exhibit 4 suggests that this monetary shift did not produce significant differences in the relative GDP performance in the two periods.

We seek to examine indices of publicly-traded property companies in the Eurozone countries to compare their performance to the 'small cap' and overall stock market behaviour in those countries. Data are analysed for two different time periods. For the Core group the effective date of monetary integration is assumed to be January 1996. For the non-core group the effective date of monetary integration is taken as January 1999. This causes a short sample problem. For Core countries reliable data are only available for 36 months prior to convergence, for non-Core, we have 36 observations "after" the event. There is a possibility that country-or sector specific shocks may, in the short term, mask structural breaks. There are two further potential 'masking' issues that need to be considered. First, the last six years have been associated with relatively geographically synchronised bull and bear markets. Second, given that the series is in dollars, the Euro currencies had been generally appreciating against the dollar in the period 1997-1999 and then depreciating in the period 1999-2001[2].

[2] Lizieri *et al.* (2003) note that the mean correlation between Eurozone countries exchange movements against the dollar in the pre-1997 period was 0.90, so the actual impact may not be huge.

Exhibit 1: Variation in Treasury Bill Rates, Non-Core Countries

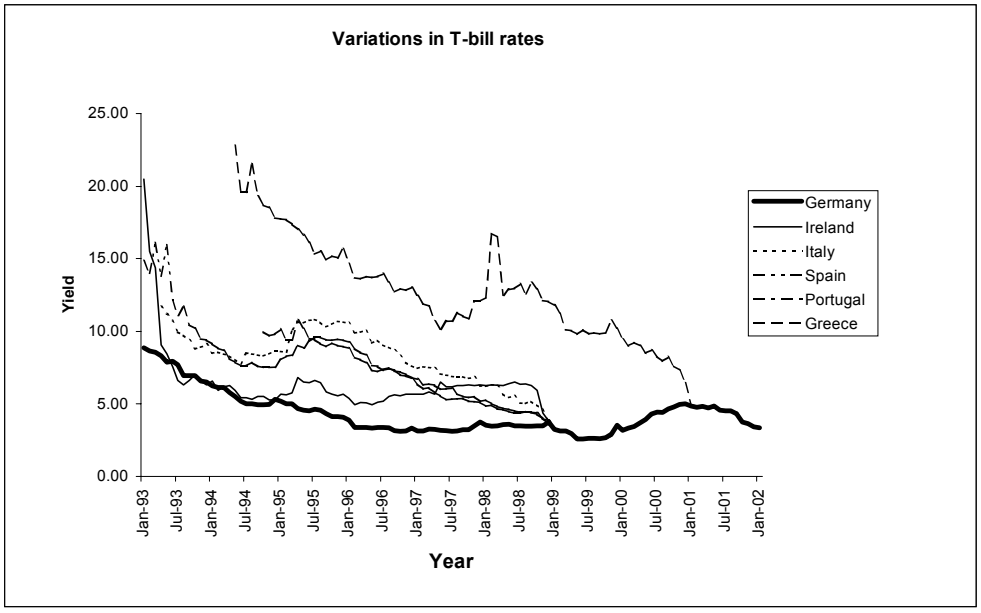


Exhibit 2: Variation in Treasury Bill Rates : Core Countries

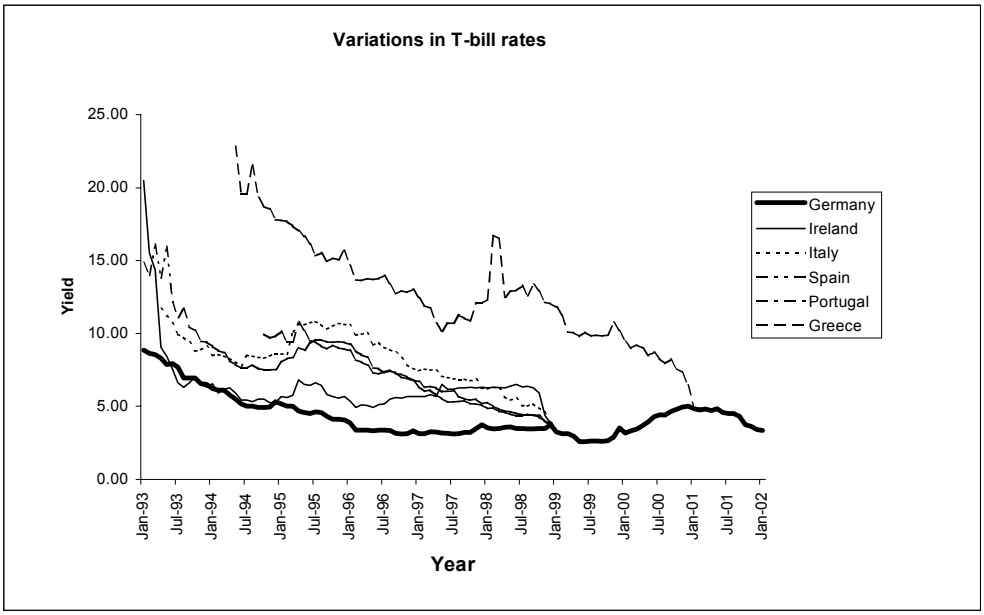


Exhibit 3: Change in Short-Term Real Interest Rates

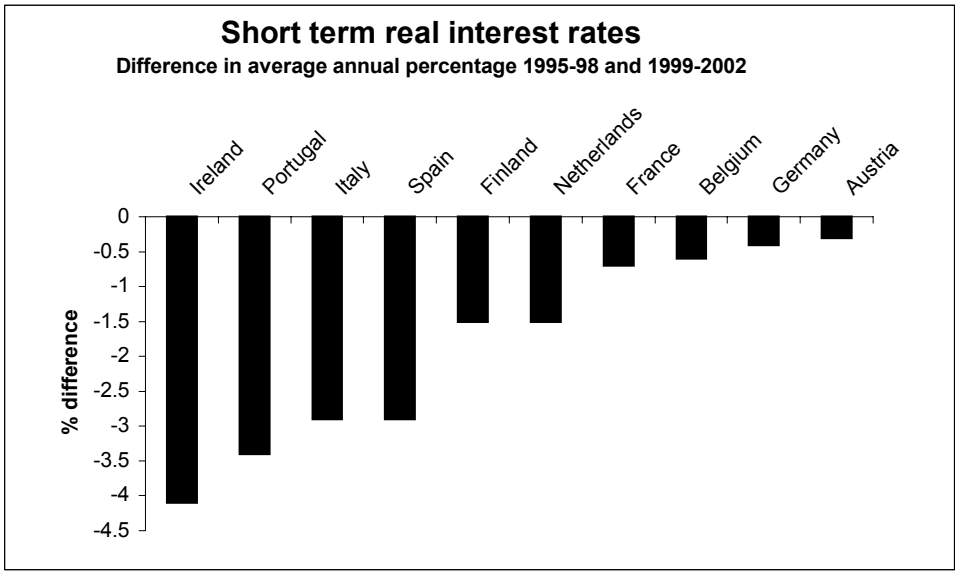


Exhibit 4: GDP Growth, 1995-1998 and 1999-2001

	GDP growth 1995 1998			GDP growth 1999-2001	
Rank	Country	Growth p.a.	Rank	Country	Growth p.a.
1	Ireland	9.30	1	Ireland	9.43
2	Portugal	3.68	2	Spain	3.67
3	Netherlands	3.50	3	Finland	3.50
4	Spain	3.38	4	France	3.07
5	UK	2.98	5	Portugal	2.90
6	Denmark	2.70	6	Netherlands	2.77
7	EU	2.41	7	Belgium	2.67
8	Belgium	2.35	8	EU	2.55
9	Austria	2.18	9	UK	2.43
10	Italy	1.96	10	Austria	2.27
11	Finland	1.65	11	Denmark	2.10
12	France	1.65	12	Italy	2.08
13	Germany	1.48	13	Sweden	1.97
14	Sweden	1.25	14	Germany	1.80

Following a brief discussion of the descriptive statistics, our data analysis consists of three approaches; standard deviation of returns, correlations between returns and a two factor model. We begin by examining the correlation coefficients between the country indices. Two analyses are performed. First, we examine the cross-sectional average correlation between countries in the period the date of monetary integration.

Given the discussion above, prior expectations are difficult to form. It is possible to generate plausible cases for increased and decreased integration. We propose that increased integration should be associated with the average correlation between European countries will increasing in the post-convergence period and that cross-sectional standard deviations will fall. In order to disentangle the separate effects of European monetary integration from global financial integration, we also test for the relative importance of global as against European integration factors using econometric methods. To obtain a 'pure' European factor, we first regress the European index returns on the global index returns and save the residuals. For each of the three groups of equities, we estimate the equation:

$$R_{Et} = \alpha + \beta_E R_{wt} + e_t$$

(Equation 1)

Where R_E is the US dollar weighted excess return on a European index at time period *t,* R_{wt} is the US dollar weighted excess turn on a global index at time period *t,* α is a constant, β_E is the return sensitivity of the European return to returns on the global index. R_{wt} is the US dollar weighted excess turn on a global index at time period *t,* e_{it} is the error term.

The residuals from Equation 1 are retained as a proxy for a unique European equity factor which is orthogonal to the global factor by construction. We then estimate the following two factor equation:

$$R_{it} = \alpha_i + \beta_{iW} R_{Wt} + \beta_{iE} e_t + \mu_{it}$$

Equation 2

For analysis, we have used monthly return data: using higher frequency data, while increasing the number of observations, is likely to introduce excess noise into the analysis. Since we examine the effect of monetary union, we cannot assume fully hedged

indices without accounting for hedging costs, so we convert all series to provide US dollar returns[3]. Thus, the analysis is conducted from the perspective of an investor whose wealth portfolio is dollar denominated, and whose international investments are unhedged. Although a standard approach in the international literature, this does presents a number of problems, not least in that, as many series are now reported in Euros, conversion requires the use of spliced currency series. This affects both the availability and length of data series.

Aggregate and small cap stock equity market data for the individual countries were obtained from DataStream. We use the MSCI global equity index as our equity market series and a comparable Morgan Stanley series for small cap stocks. We examined other global indices provided by DataStream and by Dow Jones: the results change little using alternative indices.

Since there are known problems with the DataStream property market series, we investigated the use of alternative sources. 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 analyse the stock market performance of public listed real estate firms. For country indices and for the European index, we use EPRA data. However, we have used the GPR global property index as our proxy for world security indices. The span of the data runs from 1993 to 2001. In some cases, notably for small cap stocks, there are insufficient firms to compute a reliable index for the early months of the series.

[3]Further, the conversion to dollars raises the possibility that apparent increases in market integration result from the coordination of dollar-Euro movements by comparison to movements of the separate currencies. Cholley-Steeley and Steeley (*op cit.*) use dollar denominated returns but report that there was little difference in results when home-country denominated returns were used. Myer *et al.* (1997) argue that exchange-rate adjusted returns provide stronger evidence of structural change but found that in three or four cases there were no differences in Johansen test results for cointegration between nominal, real or exchange-rate adjusted series. Similarly, Eichholtz *et al.* (1998) report no difference between US dollar and local currency results in their investigation of continental factors in real estate returns.

4. Results

Descriptive statistics

Basic descriptive statistics for the series are shown in Appendix Exhibit A1. Many series fail conventional tests of normality, largely as a result of high kurtosis – fat tails being characteristic of stock market series. This is particularly true of the real estate series, where nine of 13 series have Jarque-Bera statistics significant at the 0.01 level. While this does not affect the generality of the analysis conducted here, it needs to be borne in mind in conducting any subsequent capital market pricing analysis or modelling work. In addition, many of the real estate series show positive skewness. The overall equity series typically have higher returns than the other two series (the unweighted annualised average return for the equity series is 14.2% per annum compared to 10.6% for the real estate series and 2.4% for small caps) without noticeably greater volatility. Generally, the three sets of data conform to risk-return trade-off expectations. However, there is little relationship in the ranking of countries by returns across the data sets. The mean returns of small cap stocks have a –0.51 correlation with the mean returns of real estate stocks.

Exhibit 5 indicates the bull and bear market conditions in the 1997-2001 period. It is noticeable that European real estate stocks in aggregate do not participate in the long bull market growth phase (which is largely confined to technology and other growth stocks) but trend upwards in the bear market phase. Exhibit 6 illustrates cross-section dispersion using a twelve month trailing average of the cross-sectional standard deviation of returns for equities, real estate shares and small cap stocks. Ignoring the data driven initial fall in real estate variance (largely attributable to instability in Finland and the Scandinavian markets), cross-sectional dispersion falls for real estate equities over time. More detailed analysis suggests that the fall in real estate equity dispersion can be attributed largely to the Core Euro countries. The cross-sectional standard deviations of the Non-Core countries rise between 1997-1998 and then remain at a higher level than both those of Core and Non-Euro countries. By contrast, equity dispersion trends upwards 1977-1999 then stabilises. Small cap stocks have a more uneven pattern. For non-real estate equities, then, there is little evidence of a narrowing of absolute variation across countries.

Exhibit 5: Equity Indices, 1997-2001

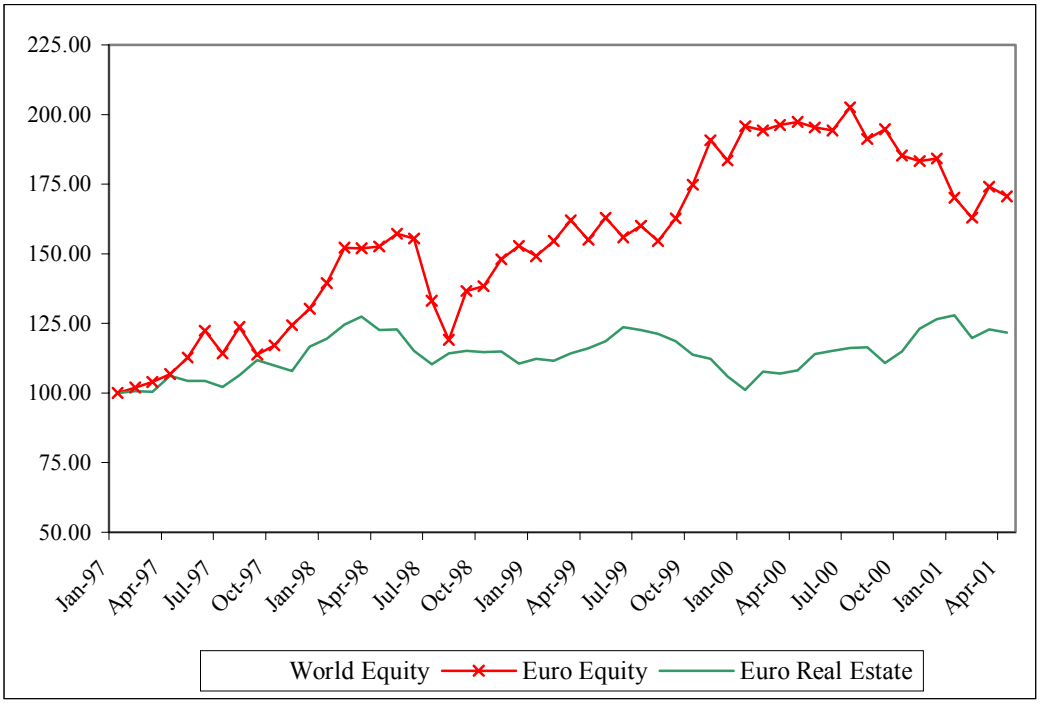
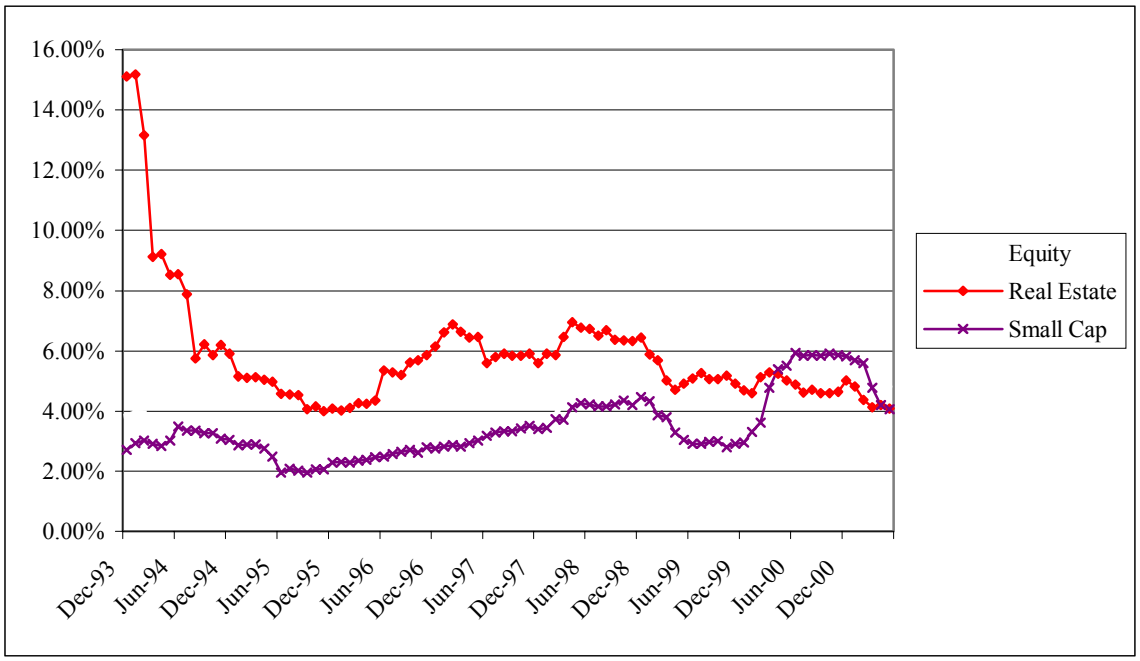


Exhibit 6: Trailing 12 month average cross-sectional standard deviations



The rolling three year correlation confirm that national real estate markets tend to be less correlated that general equity markets (see Exhibits 7, 8 and 9). Following the decrease in correlation associated with the exchange rate volatility affecting the ERM system in the mid-1990s, there has been no significant increase in correlation since 1997-8. If anything, market correlations have reduced. For real estate equities specifically, it has been *core* countries that have experienced notable increases in correlation. In contrast, correlation between *non-core* countries have decreased. In the short-run, the correlation data suggest that monetary integration has been associated with *divergence* in real estate equity markets for non-core countries.

Exhibit 7: Rolling Three Year Correlations, All Equity Indices.

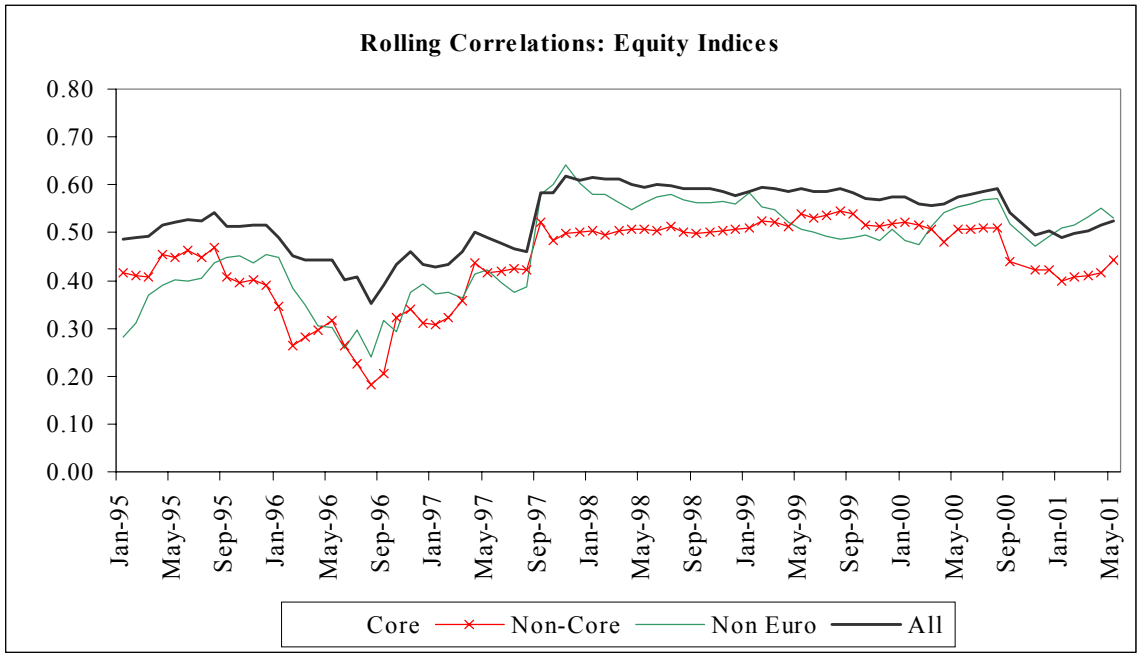


Exhibit 8: Rolling Three Year Correlations, Real Estate Indices.

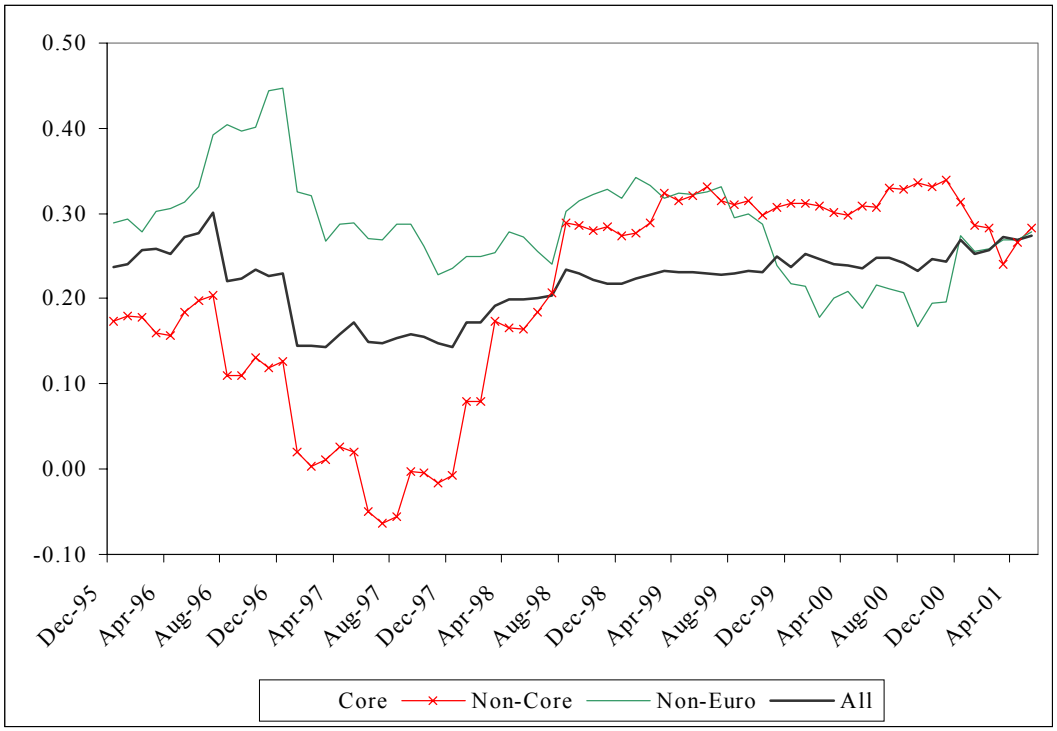


Exhibit 9: Rolling Three Year Correlations, Small Cap Stocks

Global or European integration?

Exhibit 10 shows output from the three first step regressions intended to generate the orthogonal European factors. It is noticeable that the GPR world index explains a low proportion of European property company performance relative to the explanation of European stock variation provided by the global equity index. European small cap stocks, like real estate stocks, are not strongly explained by the global index. We should note that, while we have used the Morgan Stanley global small cap index to provide consistency with overall equity indices, the Dow Jones world small cap index has a higher correlation with the DataStream European index.

Exhibit 10: European Orthogonalization Regressions, Full Sample Period

	All Equities	*Small Cap Stocks*	*Real Estate*
Constant (t)	0.003 (1.25)	-0.005 (-1.33)	0.003 (1.05)
Beta (t)	1.01 (19.04)***	0.56 (7.65)***	0.44 (5.70)***
Adjusted R^2	0.78	0.37	0.37
S.E. Regression	0.02	0.04	0.02
F Statistic	362.60***	58.44***	58.67***
Durbin Watson	2.13	1.96	1.81
AIC	-4.85	-3.55	-5.24

Notes: *Regression of relevant European index on World index, White heteroscedasticity consistent standard errors. *** significant at 0.001 level*

Exhibit A5 in the appendix shows summary results for the country equity indices over the whole sample period. For all countries in the sample, the World index has significant explanatory power at the 0.001 or 0.01 level. The average adjusted R^2 for the single factor model is 36%. Adding the European factor increases average R^2 to 43%. Only for Finland and Ireland is there no apparent European effect. There are no discernable differences between the core and non-core groups of Eurozone countries. Of the three countries outside the Eurozone, there are only weak European effects in Denmark and the UK. However, Sweden shows the strongest European influence, with betas significant at the 0.001 level and beyond and explanatory power increasing from 40% to 60%.

Exhibit A6 shows equivalent results for small cap stocks in Europe. The overall level of explanation is far lower, for both single and two factor models, adjusted R^2 averaging 19% and 29% respectively. Despite lower explanatory power, betas for the global index are significantly different from zero for all countries except Belgium. Belgium, Ireland and Sweden are not influenced by the European factor. Excluding those three countries, average explanatory power increases from 18% to 32%.

Exhibit A7 summarises the real estate results for the whole period. As implied in prior research, property indices appear to be more local/regional in nature. On average, only 7% of variation in country property company indices is explained by the GPR world real estate index. This low explanatory power holds even where β_{iW} is significantly different from zero. Only for the UK and the Netherlands is the single factor model adjusted R^2 above 20%[4]. Only Sweden and Italy appear not to be influenced by the European factor. Moving from the single factor to the two factor model increases average explanatory power to 23% (still below the small cap stock average R^2). The UK's R^2 of 68% is probably a compositional effect, with the UK property company sector making up a significant share of the European composite index. The core group of Eurozone countries appear to be more strongly influenced by the European factor than the later, non-core group and the non-Euro group with the exception of the UK.

[4] For much of the analysis period, Dutch property company investment strategy was more international than domestic in nature. However, the same could be argued regarding Swedish real estate investment.

Exhibit 11 displays the adjusted R^2 results for the single factor and two factor models for both the pre- and post-convergence periods for the three main groupings of economies[5]. As might be expected from the full period analysis, the world market index has strong explanatory power in both time periods, all Betas being significantly greater than zero at the 0.001 significance level and beyond.. The average R^2 for the later period, at 45%, is higher than for the earlier period, although we note the lower number of observations in the 1993-1995 period.

In the earlier period, the European factor is strongly significant for France, Germany and Austria and weakly significant for the Netherlands and Belgium, with an increase in the average adjusted R^2 from 31% to 45%. In the later period, the French and German indices remain strongly influenced by the European factor, the impact on the Netherlands increases, but the impact on Austrian stocks weaken. The increase in explanatory power in moving from a one- to a two-factor model is less in the second period, perhaps reflecting greater global movement patterns and the long bull market driven by growth and high tech stocks.

Exhibit 11: Explanatory Power of Global and European Factors

	Pre-convergence		***Post-convergence***	
	Single factor Model Adjusted R^2	Two factor model Adjusted R^2	Single factor Model Adjusted R^2	Two factor model Adjusted R^2
All Equity				
Core	0.31	0.44	0.45	0.52
Non-core	0.29	0.34	0.16	0.21
Non-Euro	0.26	0.37	0.51	0.56
Real Estate				
Core	0.16	0.33	0.03	0.22
Non-core	0.07	0.17	0.04	0.14
Non-Euro	0.18	0.23	0.09	0.35
Small Cap				
Core	0.02	0.18	0.09	0.28
Non-core	0.09	0.31	0.37	0.41
Non-Euro	0.13	0.25	0.26	0.30

[5] Full details of the model output can be found in Appendix 4, Exhibits A8 to A23.

For the non-core countries, there is a sample size issue as the period after the "Euro shock" is comparatively short. In the earlier period, the national indices are strongly influenced by the world index, but at best weakly influenced by the European factor. The results for the later period show a fall in explanatory power in both the single and two-factor models. The increase in average adjusted R^2 is almost entirely attributable to the association between Italian equities and the European factor. In the absence of any evidence of an increase in correlation between the indices of the non-core group, it is hard to see any evidence of equity market convergence. Indeed, whilst for all non-core countries, the European factor is significant in the pre-convergence period, this is only he case for Spain in the post-convergence period. There are insufficient data to attribute this to adjustment effects associated with the Euro regime.

The analysis performed for the all equity indices was repeated for the real estate stocks. As expected, variation in real estate stock indices is explained much less by movements in the world index than was the case for all equities. The two factor model incorporating a European factor consistently explains more of the variation than the single factor global index model but, nonetheless, there remains considerable unexplained, possibly national, variation. Most significantly, for those countries that adopted the Euro, the two-factor model explains *less* of the variation in returns in the post convergence period.

For the core countries, in the pre-1996 period, only French returns are strongly associated with movements in the world index and, in particular, in the European factor. After 1996, the European factor becomes more important: betas are statistically significant for all five countries. The world index becomes of less significance, only the beta of the Netherlands being strongly different from zero. In the post-convergence period, the adjusted R^2 for the single factor models is 3%. This result provides confirmation for the trends observed in the rolling correlations, above. By contrast, for the non-core countries, the explanatory power of the European factor weakens after 1999 – with the one exception of Spain, whose beta with the European factor is strongly significant. It is the non-EU countries that show the strongest link to the European factor, particularly post 1996. As noted

above, the UK result needs to be treated with some caution given that UK property companies made up a large proportion of the EPRA property index.

Caution is necessary in interpreting the small cap stock results given data problems and unstable composition of the indices. For Core countries, in the pre-1996 period, the world factor has little influence (with no country exhibiting a significant beta). The European stock factor is significant for France, Germany and the Netherlands, but increases the adjusted R^2 from just 2% to 18%. After lock-in, the world index becomes more significant, but still only explains 9% of variation. The European factor is significant for all countries bar Belgium; its inclusion increases the adjusted R^2 to 28%. This is largely driven by the increase in explanatory power in the Netherlands (from 5% to 47%).

Data for non-Core countries is unstable: for much of the period figures are only available for Spain and Italy. In the pre-convergence period, the European factor increases explanatory power from 9% to 31%. In the post-convergence period, the global factor becomes more important: the betas on the European factor are, in all cases, insignificantly different from zero and adding in the European factor *decreases* the average R^2 from 41% to 37%. There is, thus, no evidence of a post-Euro convergence in small cap stocks for the non-Core countries. Of the non-Euro countries, UK small cap stocks moved with both World and European factors (inclusion of the European factor increasing explanation from 26% to 47%. Swedish small cap stocks seem unaffected by either factor. Post-1997, Swedish stocks are linked to world equities but not to the Euro factor, while UK stocks are related to both. On average, adding in the Europe factor increases the adjusted R2 from 26% to 30%, all driven by behaviour of the UK index.

5. Summary and Conclusions

This paper assesses the impact of the monetary integration on different types of stock returns in Europe. In particular, it investigates the extent to which input convergence (a common currency and interest rate) has produced output convergence in equity returns. There is no automatic presumption that nominal (input) convergence will be produce real (output) convergence. Where economies within single currency areas are experiencing contrasting economic performances, the inability to use the exchange rate, monetary policy and, to a lesser extent, fiscal policy as adjustment mechanisms can serve to intensify differences in the level of economic (and real estate) activity. In order to isolate European factors, the impact of a global equity integration and small cap factors are investigated. Further, the European countries are sub-divided according to the process of monetary convergence.

One finding is that differences in real estate price movements cannot simply be attributed to a small cap effect since there is negative correlation between the small cap sector and the real estate sector. Nor do real estate and small cap have similar drivers. Analysis over the whole period shows that national equity indices are strongly influenced by global market movements, with a European stock factor providing additional explanatory power. The single and two factor models explain small cap and real estate stocks much less well – probably indicating the increased importance of 'local' drivers. The global factor is more significant for small cap stocks than for real estate. Although a European property factor strengthens the amount of variation in real estate stock prices explained, but there remains considerable unexplained variation.

The data when broken down by time period present some relatively clear-cut results that are difficult to explain. For the wider equity markets, there is some evidence of convergence in overall equity returns – but this relates as much to global integration as to European monetary integration. For real estate, there are notable differences between core and non-core countries. It is clear that the core European countries do exhibit convergence – a convergence to a European rather than a global factor. In marked

contrast, the non-core, southern countries that might have been anticipated as experiencing the greatest impact from the macro-economic changes associated with the Euro project do not seem to exhibit common trends or movements. For the non-core countries, monetary integration has been associated with increased dispersion of returns, lower correlation and lower explanatory power of a European factor. This may be explained by divergence in underlying macro-economic drivers between core and non-core countries in the post-Euro period. Variations in real interest rates, in particular, will have divergent effects on real estate market drivers. Further it may simply be that it is too soon for such trends to emerge as the adjustment processes take their effect.

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APPENDIX 1: DESCRIPTIVE STATISTICS

Exhibit A1: Descriptive Statistics, Excess Returns

Panel A: Equity							
	Mean	Median	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	P(J-B = 0)
Austria	0.09%	0.32%	5.80%	-0.019	4.431	8.543	0.014
Belgium	0.57%	0.38%	4.36%	-0.550	4.987	21.493	0.000
Denmark	0.90%	1.33%	4.76%	-0.427	3.303	3.421	0.181
Finland	2.71%	2.37%	9.64%	0.194	4.967	16.747	0.000
France	0.90%	0.69%	5.29%	0.134	2.939	0.313	0.855
Germany	0.67%	1.13%	4.74%	-0.373	3.340	2.803	0.246
Greece	1.60%	1.19%	9.24%	0.840	5.560	39.066	0.000
Ireland	1.26%	1.45%	5.35%	-0.367	4.982	18.605	0.000
Italy	0.98%	-0.34%	6.77%	0.569	2.901	5.439	0.066
Netherlands	1.05%	1.14%	4.65%	-0.151	3.256	0.655	0.721
Portugal	0.85%	0.97%	6.34%	0.707	6.074	47.704	0.000
Spain	1.17%	0.44%	6.02%	0.209	4.090	5.684	0.058
Sweden	2.14%	2.53%	7.58%	0.054	3.397	0.705	0.703
UK	0.69%	0.86%	3.96%	-0.442	2.942	3.276	0.194
Europe	***1.27%***	***1.48%***	***4.58%***	***-0.402***	***3.961***	***6.537***	***0.038***
World	*0.98%*	*1.32%*	*4.01%*	*-0.358*	*3.431*	*2.903*	*0.234*

Panel B: Real Estate							
	Mean	Median	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	P(J-B = 0)
Belgium	-0.04%	-0.85%	4.08%	0.447	3.995	7.459	0.024
Denmark	1.26%	0.48%	6.22%	1.517	8.045	144.413	0.000
Finland	1.64%	-1.21%	18.67%	2.657	15.040	721.723	0.000
France	0.51%	-0.09%	4.45%	0.334	3.076	1.884	0.390
Germany	0.02%	-0.13%	6.50%	-0.295	5.061	19.143	0.000
Ireland	2.46%	0.65%	18.61%	7.584	69.674	19480.970	0.000
Italy	0.33%	-1.27%	8.76%	1.395	5.988	69.639	0.000
Netherlands	0.19%	0.05%	3.54%	-0.001	2.763	0.234	0.890
Norway	1.76%	0.19%	11.07%	4.189	30.672	3483.013	0.000
Portugal	0.15%	-0.71%	5.75%	0.856	4.157	17.775	0.000
Spain	1.11%	0.37%	7.62%	0.388	2.846	2.611	0.271
Sweden	0.74%	-0.26%	9.95%	2.345	11.853	418.206	0.000
UK	0.79%	0.89%	4.96%	-0.295	3.105	1.498	0.473
Europe	***0.42%***	***0.19%***	***3.44%***	***0.210***	***3.153***	***0.832***	***0.660***
World	*0.25%*	*0.28%*	*3.87%*	*-0.010*	*4.533*	*9.800*	*0.007*

Panel C: Small Cap Stocks							
	Mean	Median	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	P(J-B = 0)
Austria	-0.10%	-0.16%	4.20%	0.666	4.143	8.472	0.014
Belgium	0.28%	0.07%	4.76%	0.221	2.922	0.703	0.704
France	0.45%	-0.31%	5.36%	0.346	3.082	2.021	0.364
Germany	-0.05%	-0.88%	4.33%	-0.100	3.052	0.179	0.914
Ireland	-0.79%	-1.95%	4.70%	0.459	2.240	0.946	0.623
Italy	0.10%	-0.25%	8.76%	0.222	7.321	78.622	0.000
Netherlands	0.31%	1.15%	5.56%	0.113	3.227	0.430	0.807
Spain	0.66%	0.08%	7.36%	2.860	18.468	1133.276	0.000
Sweden	0.77%	0.36%	8.75%	0.640	4.377	14.726	0.001
UK	0.39%	0.55%	4.86%	-0.283	3.005	1.334	0.513
Europe	***-0.18%***	***-0.57%***	***4.98%***	***0.272***	***4.048***	***5.746***	***0.057***
World	*0.63%*	*1.05%*	*5.43%*	*0.152*	*5.656*	*29.474*	*0.000*

Appendix Two: Correlations Between Series

Exhibit A2: Contemporaneous Correlation: World Indices

	Equities	Small Cap	Real Estate
Equities	1.00		
Small Cap	0.61	1.00	
Real Estate	0.61	0.43	1.00

Exhibit A3: Contemporaneous Correlation: European Indices

	Equities	Small Cap	Real Estate
Equities	1.00		
Small Cap	0.68	1.00	
Real Estate	0.41	0.33	1.00

Exhibit A4: Contemporaneous Correlation: European Unique Factors

	Equities	Small Cap	Real Estate
Equities	1.00		
Small Cap	020	1.00	
Real Estate	0.36	0.18	1.00

Appendix 3: Full Series Factor Models

Exhibit A5: Summary Results for All Equity Indices

One and Two Factor Models
MSCI Monthly Data (US dollar returns)
February 1993-May 2001

Equities	1993-2001				Single factor model	Two factor Model
Country	β_{iW}		β_{iE}		Adjusted R^2	Adjusted R^2
Austria	0.80	***	0.80	***	0.30	0.40
Belgium	0.56	***	0.41	*	0.26	0.29
Denmark	0.67	***	0.43	*	0.32	0.35
Finland	1.55	***	0.42		0.41	0.41
France	0.92	***	0.93	***	0.49	0.63
Germany	0.83	***	0.74	***	0.49	0.60
Greece	0.65	**	1.08	*	0.07	0.12
Ireland	0.71	***	-0.03		0.28	0.27
Italy	0.81	***	1.11	***	0.22	0.34
N'lands	0.86	***	0.52	***	0.54	0.60
Portugal	0.72	***	1.11	***	0.20	0.33
Spain	1.00	***	0.54	*	0.44	0.47
Sweden	1.20	***	1.47	***	0.40	0.56
UK	0.75	***	0.28	*	0.57	0.60
Average					0.36	0.43

Exhibit A6: Summary Results for Small Cap Stock Indices

Two Factor Model
MSCI Small Cap Monthly Data (US dollar returns)
February 1993-May 2001

Small cap Country	β_{iW}		β_{iE}		Single factor model Adjusted R^2	Two factor Model Adjusted R^2
Austria	0.29	***	0.42	***	0.18	0.33
Belgium	0.02		0.15		-0.01	-0.01
France	0.41	***	0.58	***	0.16	0.34
Germany	0.27	***	0.42	***	0.11	0.25
Ireland	0.38	***	-0.03		0.46	0.41
Italy	0.59	***	0.86	***	0.13	0.27
N'lands	0.54	***	0.58	***	0.26	0.42
Spain	0.55	***	0.65	***	0.16	0.27
Sweden	0.68	***	0.33		0.17	0.18
UK	0.46	***	0.47	***	0.27	0.40
Average					0.19	0.29

Exhibit A7 Summary Results for Real Estate Equity Indices

One and Two Factor Model
EPRA Monthly Data (US dollar returns)
February 1993-May 2001

Real estate equities					Single factor model	Two factor model
Country	β_{iW}		β_{iE}		Adjusted R^2	Adjusted R^2
Belgium	0.27	***	0.65	***	0.06	0.28
Denmark	0.35	*	0.52	*	0.04	0.13
Finland	1.01	*	1.90	**	0.03	0.12
France	0.30	***	1.00	***	0.06	0.51
Germany	0.00		0.72	***	-0.01	0.09
Ireland	1.20	**	2.03	***	0.05	0.15
Italy	0.10		0.57		-0.01	0.02
N'lands	0.43	***	0.46	***	0.21	0.36
Portugal	0.12		0.61	**	0.00	0.09
Spain	0.73	***	0.96	***	0.13	0.26
Sweden	0.74	**	0.22		0.07	0.07
UK	0.63	***	1.11	***	0.23	0.68
Average					0.07	0.23

Appendix Four: Sub-Period Analyses, Factor Models

Exhibit A8: Core Countries, All Equities, pre-1996

Two Factor Model Core countries
MSCI Monthly Data (US dollar returns)
February 1993-December 1995

Equities			Single factor Model	Two factor model
Country	β_{iW}	β_{iE}	Adjusted R^2	Adjusted R^2
Austria	1.02 ***	1.22 **	0.24	0.47
Belgium	0.73 ***	0.49 *	0.31	0.39
Finland	1.64 ***	0.07	0.38	0.36
France	0.93 ***	1.14 ***	0.25	0.47
Germany	0.71 ***	0.9 **	0.18	0.39
N'lands	0.91 ***	0.46 *	0.48	0.53
Average			0.31	0.44

Exhibit A9: Core Countries, All Equities, post-1996

Two Factor Model – Core countries
MSCI Monthly Data (US dollar returns)
January 1996-May 2001

Equities			Single factor Model	Two factor model
Country	β_{iW}	β_{iE}	Adjusted R^2	Adjusted R^2
Austria	0.77 ***	0.63 *	0.32	0.48
Belgium	0.53 ***	0.39	0.24	0.26
Finland	1.52 ***	0.64	0.41	0.42
France	0.93 ***	0.82 ***	0.58	0.68
Germany	0.86 ***	0.67 ***	0.6	0.67
N'lands	0.84 ***	0.58 **	0.56	0.61
Average			0.45	0.52

Exhibit A10: Non-Core Countries, All Equities, pre-1999

Two Factor Model – Non core countries
MSCI Monthly Data (US dollar returns)
February 1993-Decmber 1998

Equities			Single factor Model	Two factor model
Country	β_{iW}	β_{iE}	Adjusted R^2	Adjusted R^2
Spain	1.09 ***	0.51 *	0.48	0.50
Greece	0.70 **	1.06 *	0.10	0.16
Ireland	0.82 ***	0.01	0.35	0.34
Italy	0.83 **	0.85 *	0.22	0.28
Portugal	0.88 **	1.22 **	0.30	0.44
Average			0.29	0.34

Exhibit A11: Non-Core Countries, All Equities, post-1999

Two Factor Model – Non core countries
MSCI Monthly Data (US dollar returns)
January 1999-May 2001

Equities			Single factor Model	Two factor model
Country	β_{iW}	β_{iE}	Adjusted R^2	Adjusted R^2
Spain	0.79 ***	0.51	0.43	0.38
Greece	0.50	1.04	0.00	0.00
Ireland	0.43	-0.27	0.13	0.10
Italy	0.83 **	1.72 **	0.19	0.52
Portugal	0.32	0.62	0.01	0.04
Average			0.16	0.21

Exhibit A12: Non-Euro Countries, All Equities, pre-1996

Two Factor Model – Non € countries
MSCI Monthly Data (US dollar returns)
February 1993-December 1995

Equities			Single factor Model	Two factor Model
Country	β_{iW}	β_{iE}	Adjusted R^2	Adjusted R^2
Denmark	0.68 **	0.20	0.19	0.17
Sweden	1.18 **	1.91 ***	0.13	0.39
UK	0.94 ***	0.47 *	0.46	0.56
Average			0.26	0.37

The results for the sub-period 1993-1998 are not materially different.

Exhibit A13: Non-Euro Countries, All Equities, post-1996

OLS Estimation
Two Factor Model – Non € countries
MSCI Monthly Data (US dollar returns)
January 1996-May 2001

Equities			Single factor Model	Two factor Model
Country	β_{iW}	β_{iE}	Adjusted R^2	Adjusted R^2
Denmark	0.67 ***	0.56 *	0.36	0.40
Sweden	1.21 ***	1.24 ***	0.53	0.65
UK	0.71 ***	0.72	0.63	0.64
Average			0.51	0.56

The results for the sub-period 1999-2001 are not materially different.

Exhibit A14: Core Countries, Real Estate, pre-1996

Two Factor Model – Core countries
EPRA Monthly Data (US dollar returns)
February 1993-December 1995

Real estate equities			Single factor Model	Two factor Model
Country	β_{iW}	β_{iE}	Adjusted R^2	Adjusted R^2
Belgium	0.26	0.48 *	0.16	0.27
Finland	1.88	3.22	0.11	0.18
France	0.36 **	1.22 ***	0.24	0.66
Germany	-0.03	0.48	-0.03	0.04
N'lands	0.37 **	0.66 **	0.30	0.52
Average			0.16	0.33

Exhibit A15: Core Countries, Real Estate, post-1996

Two Factor Model – Core countries
EPRA Monthly Data (US dollar returns)
January 1996-December May 2001

Real estate equities			Single factor Model	Two factor Model
Country	β_{iW}	β_{iE}	Adjusted R^2	Adjusted R^2
Belgium	0.3 *	0.73 ***	0.02	0.28
Finland	0.17	1.05 *	-0.02	0.06
France	0.22 *	0.88 ***	0.00	0.41
Germany	0.06	0.83 **	-0.02	0.09
N'lands	0.43 ***	0.39 **	0.17	0.27
Average			0.03	0.22

Exhibit A16: Non-Core Countries, Real Estate, pre-1999

Two Factor Model – Non-core countries
EPRA Monthly Data (US dollar returns)
February 1993-December 1998

Real estate equities			Single factor Model	Two factor Model
Country	β_{iW}	β_{iE}	Adjusted R^2	Adjusted R^2
Ireland	1.38 *	2.52 **	0.04	0.15
Italy	0.34	0.96 **	0.00	0.09
Portugal	0.18	0.69 **	-0.01	0.10
Spain	0.95 ***	0.81 **	0.24	0.34
Average			0.07	0.17

Exhibit A16: Non-Core Countries, Real Estate, post-1999

Two Factor Model – Non-core countries
EPRA Monthly Data (US dollar returns)
January 1999-May 2001

Real estate equities			Single factor Model	Two factor model
Country	β_{iW}	β_{iE}	Adjusted R^2	Adjusted R^2
Ireland	0.87 *	0.69	0.20	0.26
Italy	-0.66	-0.09	0.04	0.00
Portugal	-0.09	0.04	-0.04	-0.03
Spain	-0.51	1.74 ***	-0.03	0.32
Average			0.04	0.14

Exhibit A17: Non-Euro Countries, Real Estate, pre-1996

Two Factor Model – Non-€ countries
EPRA Monthly Data (US dollar returns)
February 1993-December 1995

Real estate equities			Single factor Model	Two factor Model
Country	β_{iW}	β_{iE}	Adjusted R^2	Adjusted R^2
Denmark	0.46	0.24	0.04	0.02
Sweden	1.31	-0.85	0.06	0.05
UK	0.71 ***	0.92 ***	0.44	0.63
Average			0.18	0.23

Exhibit A18: Non-Euro Countries, Real Estate, post-1996

Two Factor Model – Non-€ countries
EPRA Monthly Data (US dollar returns)
January 1996-May 2001

Real estate equities			Single factor Model	Two factor model
Country	β_{iW}	β_{iE}	Adjusted R^2	Adjusted R^2
Denmark	0.34 *	0.6 **	0.02	0.14
Sweden	0.54 ***	0.51 **	0.12	0.21
UK	0.6 ***	1.17 ***	0.12	0.71
Average			0.09	0.35

The results for the sub-period 1999-2001 are not materially different.

Exhibit A19: Core Euro Countries, Small Cap Stocks, pre-1996

Two Factor Model – Core countries
MSCI Small Cap Monthly Data (US dollar returns)
February 1993-December 1995

Small cap Country	B_{iw}	B_{iE}	Single factor Model Adjusted R^2	Two factor Model Adjusted R^2
Belgium	0.26	0.1	-0.01	-0.06
France	0.37	0.67 **	0.03	0.31
Germany	0.24	0.51 **	0.01	0.21
N'lands	0.36	0.56 **	0.06	0.24
Austria	**Insufficient data**			
Average			0.02	0.18

Exhibit A20: Core Euro Countries, Small Cap Stocks, post-1996

Two Factor Model – Core countries
MSCI Small Cap Monthly Data (US dollar returns)
January 1996-May 2001

Small cap Country	B_{iw}	B_{iE}	Single factor Model Adjusted R^2	Two factor Model Adjusted R^2
Belgium	0.00	0.16	-0.01	-0.02
France	0.41 **	0.57 **	0.2	0.35
Germany	0.28 **	0.38 **	0.04	0.25
N'lands	0.56 **	0.58 **	0.05	0.47
Austria	0.29 **	0.43 **	0.17	0.33
Average			0.09	0.28

Exhibit A21: Non-Core Euro Countries, Small Cap Stocks, pre-1999

Two Factor Model – Non-core countries
MSCI Small Cap Monthly Data (US dollar returns)
February 1993-December 1998

Small cap Country	B_{iw}	B_{iE}	Single factor Model Adjusted R^2	Two factor Model Adjusted R^2
Spain	0.48 **	0.52 **	0.16	0.30
Italy	0.35	1.19 **	0.02	0.32
Average			0.09	0.31

Exhibit A22: Non-Core Euro Countries, Small Cap Stocks, post-1999

Two Factor Model – Non-core countries
MSCI Small Cap Monthly Data (US dollar returns)
January 1999-May 2001

Small cap Country	B_{iw}	B_{iE}	Single factor Model Adjusted R^2	Two factor model Adjusted R^2
Spain	0.63 *	0.9	0.18	0.23
Ireland	0.38 **	-0.04	0.46	0.41
Italy	0.86 **	0.09	0.36	0.34
Average			0.41	0.37

Data for Ireland is February 2000-May 2001

Exhibit A23: Non-Euro Countries, Small Cap Stocks, pre-1997

OLS Estimation
Two Factor Model – Non-€ countries
MSCI Small Cap Monthly Data (US dollar returns)
February 1993-December 1996

Small cap Country	B_{iw}	B_{iE}	Single factor Model Adjusted R^2	Two factor Model Adjusted R^2
Sweden	0.4	0.51	-0.01	0.02
UK	0.72 **	0.5 **	0.26	0.47
Average			0.13	0.25

Exhibit A23: Non-Euro Countries, Small Cap Stocks, post-1997

Two Factor Model – Non-€ countries
MSCI Small Cap Monthly Data (US dollar returns)
January 1997-May 2001

Small cap Country	B_{iw}	B_{iE}	Single factor Model Adjusted R^2	Two factor Model Adjusted R^2
Sweden	0.71 **	0.22	0.24	0.23
UK	0.44 **	0.43 **	0.28	0.37
Average			0.26	0.30

The results for the sub-period 1999-2001 are not materially different