

**Convergence in European Real Estate Markets: Theoretical  
Perspectives and Empirical Evidence**

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## **Abstract**

This paper examines the concept and investigates the evidence of convergence in European real estate investment markets. The term 'convergence' has been described as suffering from "meaning-overload" (Quah, 1996, p.1). A number of facets of convergence are examined. Particular attention is paid the concepts of  $\sigma$ -convergence and  $\beta$ -convergence, their implications for patterns of growth and co-movement and the well-developed methodological critique of convergence empirics. Given the manifest relevance of national and regional economic growth to real estate performance, empirical research on regional economic convergence within the EU is critically reviewed. A number of convergence tests are applied to levels of office rent for 25 European cities between 1984 and 1999. The results suggest that it is difficult to identify any pattern of convergence in both real estate drivers and real estate office rentals within the EU.

## **Introduction**

Issues related to convergence and market integration within national and continental economies and real estate markets have implications for the relative success of real estate investment decisions. Given the nature of commercial real estate as a derived demand, changes in demand drivers will influence investment performance in terms of overall returns and diversification potential. Regional and national inequalities in productivity, unemployment and economic growth *inter alia* have generated a substantial literature. In turn, the repercussions of further European integration for these inequalities have been the source of discussion and debate. Given the conflicting predictive elements of neo-classical and endogenous growth theories, there is no clear theoretical basis for forming *a priori* expectations of patterns of regional and national development. Whilst the causes, nature and persistence of inequalities have obvious implications for regional policy formation; they are also of interest to real estate investors whose assets are ‘embedded’ in the economies of these regions.

The paper examines the extent to which increased integration within the EU has produced convergence in real estate markets? Conventional convergence tests are applied to the rental levels of major European office markets. The remainder of the paper is organised as follows. The first section reviews existing research on convergence and integration among European real estate markets. This is followed by a critical examination of the various aspects of the concept of convergence and an evaluation of conventional methodologies. The third section reviews existing research on trends in regional convergence and cohesion within the European Union. The final section sets out the data used in the study and discusses the limitations of data on European real estate markets. This is followed by the application of the tests for sigma and gamma/beta convergence and a discussion of the results.

## **Defining Convergence**

Given that the term is used widely in the business, finance and economics literature, convergence suffers from “meaning-overload” (Quah, 1996, p.1). Obviously, since conceptual foundations shape empirical investigation in terms of data analysed, methodology and, ultimately, results and conclusions, it is worthwhile allocating some space to a discussion of the different facets of the term.

In this context, there are two main relevant approaches to the analysis of convergence. In the financial economics literature, convergence is often interchangeable with (although less

commonly used than) integration with the latter also suffering from a surfeit of connotations. Definitions of integration (which are, in turn, very similar to some definitions of globalization) focus on changes in the relative importance of national borders as economic and financial frontiers. Where integration is advanced, there are few formal and informal barriers to trade, capital movement, investment and market entry. In perfectly integrated asset markets, national market factors should have no effect on asset pricing. This is essentially the perspective from which the finance literature has approached the investigation of convergence in European capital markets. The focus has been on identifying changes in market correlation and in the explanatory power of national and/or common factors relative to European and global factors in determining returns.

Following this vein, empirical approaches to the investigation of market integration have tested whether the Capital Asset Pricing Model and Arbitrage Pricing Theory holds in an international context (see Alford, 1993 for a full discussion). CAPM studies attempt to identify whether separate national markets yield an excess return – a segmentation ‘gain’. APT-derived studies of market integration focus on the existence of common factors that explain historic returns. Results indicating that markets are being driven by common factors are taken as evidence of integration. In the property literature, this is essentially the approach of Van Daalhuizen *et al* (2000) who examine the relative importance of national and common factors in explaining historic office market returns in European cities relative to continental and diverse factors. In the capital markets literature, Rouwenhurst (1999) examines the importance of country and industry effects in explaining equity returns in European equity markets over the last two decades. He finds that there has been little change in the significance of country effects.

The analysis of the conceptual basis and methodology of convergence in the regional economics literature has generated a substantial discussion and debate with a quite different perspective. Seminal work by Baumol (1986) and Barro and Sala-i-Martin (1992) set an agenda for subsequent empirical research and theoretical progression. Barro and Sala-i-Martin proposed two forms of convergence – beta and sigma.

Closely associated with tests of the neo-classical growth model, tests of beta-convergence have spawned a large empirical literature. Beta-convergence is conventionally defined as occurring when in a cross-section of economies there is a negative relationship between the growth rate of income per capita and the initial level of income. The broad predictive component of neo-classical growth theory is that poorer economies are expected to grow faster than wealthy ones. It is emphasised that convergence can be conditional upon the

structural characteristics of the region and the steady state growth rate. It is not implied that countries will converge to a common steady state growth rate, rather they will converge to their own specific steady state. However, where there are groups of regions with similar structural characteristics, they will tend to form convergence ‘clubs’ with inequalities between ‘clubs’ possibly persisting.

Tests of beta convergence investigate the linkage between an historic variable (often GDP per capita) and subsequent growth in that variable. Typically regression techniques are applied. The classic convergence formula is

$$(1/T)\log(y_{i,T} / y_{i,t}) = \beta \log(y_{i,t}) + u_{it}$$

Where  $T$  is the period over which convergence is tested,  $y_{it} = Y_{it}/Y_t$  is a measure of the variable in the  $i^{th}$  region relative to the average for the sample under investigation, the coefficient  $\beta$  represents a rate of convergence,  $u_{it}$  is the error term and  $(1/T)\log(y_{i,t+T} / y_{i,t})$  is the annualised rate of growth of the variable<sup>1</sup>. If  $\beta$  is greater than zero and less than 1, the convergence hypothesis is confirmed.

Sigma-convergence is concerned with the evolution of a distribution over time. It is conventionally defined as occurring where dispersion tends to fall over time. In the regional convergence literature, it is measured in terms of changes in the coefficient of variation in growth rates over time. Although there are important linkages between these two facets of convergence, they are not inextricably linked. Despite the fact that the presence of beta-convergence will tend to produce sigma-convergence, it is possible for low income regions to grow faster than high income countries whilst maintaining the spread of growth rates. Consequently, the absence of sigma-convergence does not preclude the presence of beta-convergence and periods of sigma-divergence are compatible with long term beta-convergence (see Martin and Sunley, 2000 for a detailed discussion of these issues).

A detailed reassessment of the growth empirics methodology has developed from both theoretical scrutiny and empirical investigation. The validity of the output from initial level regressions has been criticised as being fundamentally flawed in econometric terms. There is now general acceptance (first pointed out by Quah, 1993 and Friedman, 1992) that the use of initial level regression methods in this context provides an example of Galton’s fallacy.

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<sup>1</sup> Given methodological difficulties associated with their identification, variations in steady state growth rates are often ignored in empirical research. Consequently, where  $0 < \beta < 1$ , convergence is found to be *absolute*.

Essentially, the problem is that even where there is no sigma-convergence (and sometimes in cases of sigma-divergence) there is a structural bias<sup>2</sup> towards a negative beta in initial level regressions (see Cannon and Duck, 2000 for a detailed explanation). Consequently, although numerous empirical studies have used initial level regressions, findings of negative beta are more than likely to be a statistical artefact.

De Long (1988) also emphasises that there is a strong tendency towards sample selection bias in convergence studies. Essentially he argues that such studies tend to focus on countries for which large data sets are available.

“Long run national accounts are luxuries. Nations likely to have the historians and archives necessary to construct such accounts are nations that have converged” (De Long, 1988, p. 1141)

This point is especially pertinent to the real estate data and is discussed below.

Less fundamentally, the focus of much empirical research on sigma and beta-convergence has also been criticised on the grounds of obfuscation. Sala-i-Martin (1995) first used the analogy of the football league to illustrate that changes in the co-efficient of variation were not the only important measure of convergence. He pointed out that even where sigma convergence was absent (in a football league dispersion remains fixed), there were still interesting issues related to intra-distribution mobility. For beta convergence, as Bernard and Durlauf (1995) indicated, the cross-section initial level regression procedures work with the null hypothesis that no countries are converging and the alternative hypothesis that all countries are whilst omitting a whole host of intermediate possibilities. Quah (1993) in particular raised the potential of trends in persistence, switching, churning, and stratification *inter alia* to be equally significant in the investigation of convergence dynamics.

From empirical research, it has become clear that there can be significant inter-temporal differences in patterns of convergence across periods and across subsets of regions. Studies have found consecutive periods of divergence and convergence, whereby long-term convergence is interrupted by periods of divergence due to asymmetric shocks (with varying persistence). Commentators have pointed out that focusing on average rates of beta-convergence can be misleading and can mask often more pertinent questions related to intra-distribution or churning behaviour in the evolving distribution. (Quah, 1996 and Martin and

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<sup>2</sup> De Long (1988) also points that errors in the measurement of GDP will produce a structural bias towards a negative beta in initial level regressions.

Sunley, 2000). To what are distributions becoming multi-polar and stratifying? What is the balance between switching and persistence?

The response to the above has been the further development of convergence empirics. Drawing upon methodologies applied to the analysis of personal income inequalities, Quah (1993) used Markov chain techniques to examine trends in mobility within the distributions over time finding evidence of 'pockets' of convergence and polarisation in the data. Convergence has also been investigated by analysing time series properties of the data. Economies are taken to have converged when the time series properties of the economic indicator examined are co-integrated. The presence of co-integration implies that common factors are driving the long run performance of two economies and that any divergence will be short term and random. Bernard and Durlauf (1995) formally define convergence as being where the long term forecasts of output are *equal* at a fixed point. They also test for common trends by measuring whether the long-term forecasts are *proportional* at a fixed time. The short term nature of the data series for real estate in addition to the stationary nature of the time series effectively precludes the use of co-integration tests for European real estate markets.

Whilst recognising the importance of beta-convergence and the limitations of initial level regressions, Boyle and McCarthy (1997) proposed a relatively straightforward non-parametric methodology for testing aspects of beta-convergence. Their approach concentrates on inter-temporal changes in the ordinal rankings to measure the extent of movement within the various distributions over time essentially focussing on the issue of 'leapfrogging' or churning over time. Using variations of Kendall's index of rank concordance, they test for convergence by measuring the level of 'disagreement' in rankings over time. Where a score of 1.0 represents perfect 'agreement' and zero representing no 'agreement', the null hypothesis of no agreement is tested. If the result is insignificantly different from zero, gamma-convergence is concluded. Applying this methodology to changes in per capita GDP for 20 OECD countries, they find no evidence of significant intra-distributional mobility (Boyle and McCarthy, 1997).

In summary, it is apparent that convergence-integration is a multi-faceted concept. A key issue is the meaning that we attach to such terms. Qualitatively, it is possible to focus on institutional convergence by examining changes in legal, regulatory, fiscal and social barriers to factor mobility. Alternatively, the extent of convergence can also be quantified. Although they are inter-linked, it is possible to a number of separate approaches which, in turn, imply different questions relating to changes and trends in:-

*Co-movement:* Is the level of correlation in performance increasing? In the short term or the long-term? Are there specific sets of conditions which produce correlation increases/decreases?

*Common drivers:* Are there common international factors driving national performance? Do separate national markets display long term co-integration?

*Decreasing variation:* Is the level of variation in performance decreasing? Are distributions collapsing or expanding?

*Differential performance:* Do lagging markets grow faster than leading markets? Is there a link between initial position and subsequent performance.

### **Regional Convergence with the European Union**

There have been numerous studies of aspects of regional convergence and cohesion within the European Union. They use an assortment of data sets (unemployment, GDP<sup>3</sup>, productivity), examine different time periods, apply a variety of methodologies and test for various types of convergence. A number of stylised facts emerge from the studies. Firstly, the rate of convergence is by no means consistent over time. Studies have found periods of convergence followed by divergence. The rate of convergence tended to be fastest in the 1960's and 1970's relative to the 1980's (see Fagerberg and Verspagen, 1996). The lack of (sigma) convergence in the 1980's is further illustrated by Button and Pentecost (1995) who find remarkable stability in the coefficients of variation in regional GDP between 1977 and 1990. Secondly, there is evidence to suggest that economic both positive and negative economic shocks have contrasting effects on patterns of convergence. Empirical studies have found that economic downturns tend to be associated with divergence whereas convergence occurs in periods of faster growth (McCarthy, 2000, European Commission, 2001). Empirical studies to date suggest that there is little to suggest convergence in the 1990's.

The most recent cohesion report from the European Commission emphasises the long-term nature of the convergence process. It finds that between the bottom quartile of regions had an income of 68 per cent of the EU average in 1998 compared to 66 per cent in 1988. The lack of

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<sup>3</sup> GDP per head is the EU's favoured measure to test inequality. Unlike some empirical studies, they adjust GDP per head to reflect varying price levels between countries. Interestingly they find that where there no adjustment made for purchasing power standards, disparities are exacerbated.

convergence in this period is further reinforced by the fact that the standard deviation between regions has remained relatively stable. The report argues that, at current rates, it will take a number of decades before disparities are eliminated and without intervention this convergence may be conditional rather than absolute. Research on patterns of regional unemployment tends to confirm the high levels of persistence in economic performance (Baddeley *et al*, 1997).

There has also been a body of research examining trends in integration within the EU in a number of related fields. From the perspective of co-movement rather than catch-up, Fatas (1997) has shown that the economic performance of regional economies has become increasingly positively correlated with the EU generally rather than with the individual nation states. Further, a notable feature of the last 30 years has been the growth in intra-European trade (see Chisholm, 1995). Empirical studies (notably Ben-David, 1996) suggest that there is a strong positive relationship between the degree of bilateral trade intensity and the cross-country bilateral correlation of business cycle activity (see also Frankel and Rose, 1997). Hence, the growth in trade within the EU has tended to be associated with increasing economic similarities in terms of business cycle and income levels. Furthermore, within the EU there is empirical evidence to suggest that the pattern of economic shocks has changed with industry specific shocks becoming relatively more important than country-specific shocks (see Bayoumi and Prasad, 1997). The result is that economic shocks are increasingly symmetric within the EU.

Given the above, it seems clear that there are no strong *a priori* grounds to expect to find evidence of significant convergence within European real estate markets over the last fifteen years. Below the disparities in the office rents of major EU cities are examined to assess the extent of convergence between major national service sector centres within the EU.

## **Data**

For the purposes of this study the data source used is The Green Book. This is an online database of a large proportion of commercial, residential and construction statistics for a range of international markets focussing mainly (although not exclusively) on Europe. However, there are a number of striking flaws with European property market data. These can be classified under a number of headings.

### *Length*

Comprehensive performance monitoring is relatively new to many European markets. As a result there are relatively few reliable long-term sources of commercial property investment performance measurement. The period prior to the introduction of the 'Single Market' in 1992 was associated with a dramatic expansion of British surveying practices into the main European markets. At the same time there was a dramatic growth in market monitoring and measurement. However, the result is that much of the available data measures the 'tail-end' of a boom, a major property market downturn and a recovery. Generally for most major European centres, historic office rents are available from the early to mid-1980s with total return figures are generally only available from the early 1990s. Comparable data for the retail and industrial sectors is even more problematic. This is in marked contrast to much of the empirical work on convergence in economic performance where measures of GDP and productivity are widely available for much of this century. The relatively short time series prohibits the use of tests examining the long term structural relationships such as tests for unit roots and co-integration.

### *Continuity*

Although there are currently a large number of organisations monitoring market performance, the main relatively widespread sources of 'long term' rental series are ONCOR, ICPA, DTZ and JLW. These are used in most cases in this study. However, in a significant proportion of the individual city rental time series, there are either gaps or discontinuities. This occurs for three main reasons. First data is not collected for an individual time period. Second, the series terminates prematurely. Third the basis on which data is collected changes eg. from whole business area to disaggregation by sub-market. This limitation can be mitigated by using comparable time series data from other sources. This is usually readily available. However, as we shall see below, it is rare that recording organisations agree completely on the extent and timing of market change.

### *Selectivity*

Inevitably, any index measures attempts to measure a specific element of market performance e.g. prime offices. Following De Long's point on sample selection bias, it is clear that much of the EU data is focussed on the major international business centres. As a result, lagging

regions tend to be excluded – an important omission in terms of examining the convergence hypothesis.

### *Inconsistency*

It has already been stated that a number of organisations are trying to measure the performance of the different centres. However, the different measures produced are often inconsistent in the sense that they tell different ‘stories’ about market change. Whilst it is recognised that the bases and assumptions underpinning valuations will sometimes vary between recording organisations, the size of the disagreements about the extent and timing of market change can be surprising.

### *Use of Appraisals*

With the property research community there is a widespread belief that there is a problem with much property market data generally due to the existence of serial correlation in the time series. This is often cited as evidence of smoothing in the return series and the consequent under-recording of market volatility. Although the existence, nature and extent of smoothing can be questioned, in much of the European data there is a particular problem with quarterly rental series which tend to display extreme seasonality in the sense that rental levels change only once per year and at the same time every year. Given that zero market movement on such a consistent basis is unlikely, the explanation for the data qualities would seem to lie in the data collection process with relatively small shifts remaining unrecorded. The result is that they are effectively annual time series rather than quarterly and for the purposes of this research have been taken as such. The result is that *short term* market volatility is un- or under-recorded.

The data consists of levels of rent for 25 European cities from 1984 to 1999. The cities have been selected on the basis of data availability. As a result there is a notable bias towards countries that have relatively mature real estate markets and towards cities which are well-integrated into the global economy. According to the most recent report on economic and social cohesion within the EU, all of the cities are in regions with GDP per head (in terms of PPS) that is higher than the EU average. In order to account for differences in currency and inflation, rents have been transform in ECUs using the IMF statistics on ECU rates<sup>4</sup>. Data on

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<sup>4</sup> Euro rates have been used after 1999.

bond yields, consumer price inflation and GDP growth was extracted from the IMF's *International Financial Statistics* series.

## Results

Appendix 1 sets out the basic descriptive statistics. They indicate a strong diversity in currency-adjusted performance over the period in question. Previous research (based on similar data over a shorter time period) using cluster analysis suggested that the only stable groupings consist of

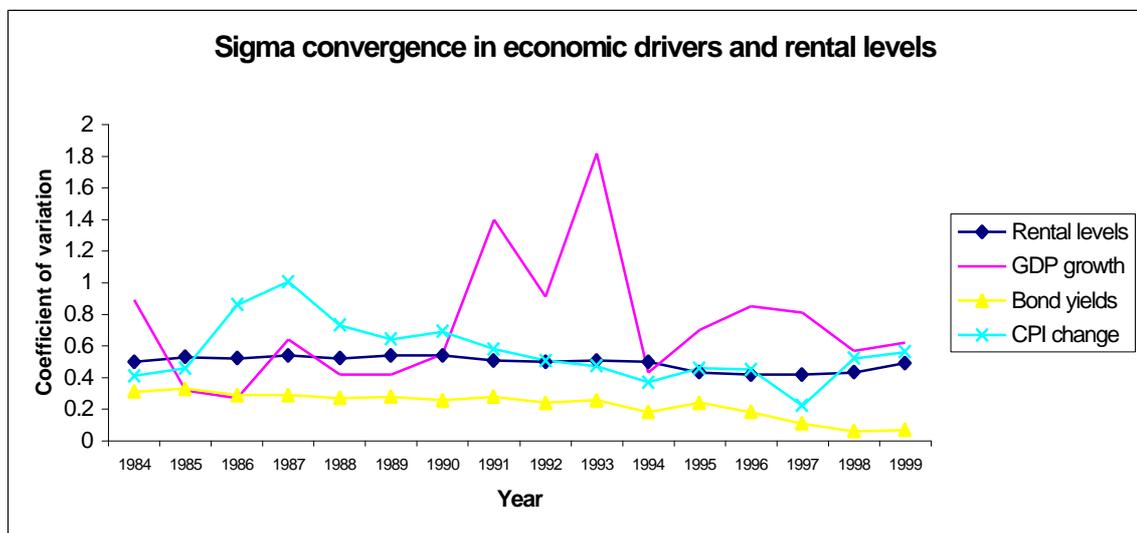
?? Berlin,

?? the 'southern' bloc of Spain and Portugal and

?? the rest (see McAllister, 1999).

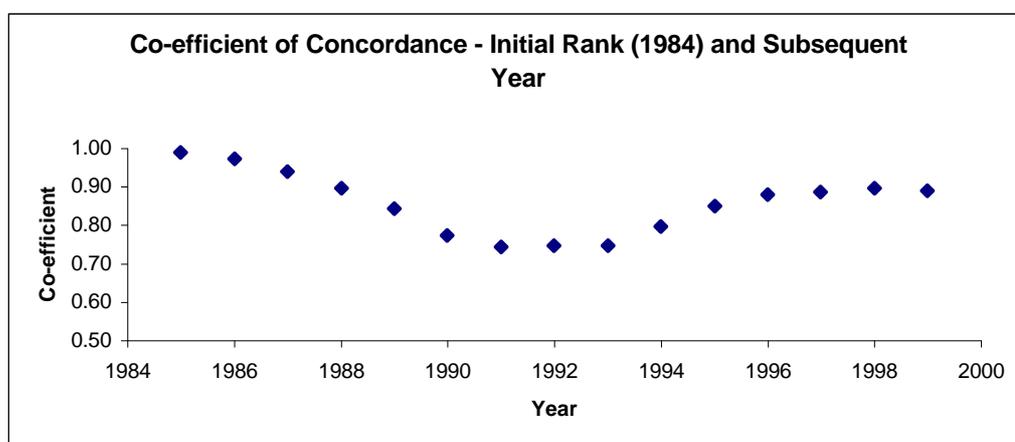
For the cities observed, there is very little evidence of sigma convergence in real estate rentals. Figure 1 illustrates trends in the dispersion of levels of rent and other economic variables among the eight countries examined in this paper. A notable feature is the relative stability of the level of dispersion in levels of rents. Despite the expected convergence of long term bond yields associated with integration of monetary policy, the lack of sigma convergence in real estate rentals is associated with a similar lack of sigma convergence in GDP growth and CPI change.

Figure 1



Evidence of gamma convergence is equally elusive, the Kendall co-efficient of concordance is 0.77 and is significantly different from zero. This can be interpreted as meaning that, throughout the whole of the period of measurement and taking into account all the variations between cities, there is no evidence of significant variation in rankings. A more detailed annual analysis of the changes in ranks further supports the no convergence hypothesis. Figure 2 illustrates the Kendall co-efficient of concordance for the initial rank and rank in subsequent individual years. This provides an indication of whether the summary measure obscures individual periods of convergence.

Figure 2



However, as with the data for sigma convergence, there is relative stability in the rankings for individual years relative to initial ranking. Except for three years where it is significantly different from zero at the 10% size of test, the observed co-efficient of concordance is significantly different from zero at the 5% size of test in all observations. However, it is also apparent that there are notable differences between the mobility of individual cities. A number of cities displayed a high degree of volatility in their relative positions.

The initial regression output further supports the no-convergence hypothesis. Applying Equation (1) to the rental information, the result is

$$(1/T)\log(y_{it,T} / y_{it}) = 0.00156 + 0.01275\log(y_{it}) + 0.0198$$

The full results are reported in Appendix 2. Whilst the limitations of initial level regressions have already been discussed at length above and are acknowledged, the pertinent point is that

the beta co-efficient (representing the annualised rate of convergence) is insignificantly different from zero and is consistent with the results of the other convergence tests.

## **Conclusion and Discussion**

This analysis suggests that it is difficult to identify any pattern to the changes in real estate drivers and real estate rentals within the EU. However, it is clear that at the level of the regional economy there has been remarkable stability in extent of disparities in economic performance. Sigma convergence in regional GDP per head has been negligible over the last three decades. Convergence in the level of regional economic inequality tend to be slow and sporadic with horizons in decades rather than years. Indeed, it is apparent that in the short to medium term exogenous shocks can often produce divergence rather than convergence.

Evidence from the real estate sector is consistent with these findings. The dispersion of rental levels has remained relatively stable between 1985 and 1999. This is consistent with stability in the dispersion of national CPI changes and GDP growth rates. Non-parametric analysis suggests that there has been limited mobility in the relative positions of individual cities. In simple terms relatively low rental cost cities have tended to remain low rental cost cities and high rental cost cities have tended to remain high rental cost cities.

The discussion of the nature of convergence and its multi-faceted nature illustrates the potential for further research in this area. Issues related to co-movement, the influence of common drivers and levels of institutional convergence have not been addressed in this paper. Moreover, it is also likely that measures of gamma and beta convergence tend to obscure interesting movements. The focus of much of the convergence research on relatively long term change can cloak significant short to medium term market adjustments that are of considerable interest to real estate investors. Further, in order to guard against trying to oversimplify what is a very complex reality, it is worth quoting Keeble who argues that

“The complexity and variety of economic forces currently at work in Europe’s regions are too great to be encompassed by any single all embracing theory of economic change..... The result is a ‘regional mosaic’ of development trajectories within Europe, in the evolution of which both macro-economic forces and local economic characteristics are important” (Keeble quoted in Chisholm, 1995, p. 91)

Of course, real estate investors are also faced with national and local variations in taxation, lease structures, regulation, quality of service providers and market maturity in developing European investment strategies.

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## Appendix 1

Rental Growth in major EU cities 1985-1999				
	City	Rental growth p.a.in ECU	Standard Deviation of variation	Coefficient
1	Utrecht	5.53%	4.84%	1.14
2	Amsterdam	6.42%	7.46%	0.86
3	The Hague	5.11%	5.96%	0.86
4	Dublin	7.97%	11.30%	0.70
5	Lille	5.40%	8.18%	0.66
6	Koln	5.45%	10.01%	0.54
7	Hamburg	3.89%	8.07%	0.48
8	Frankfurt	6.25%	13.91%	0.45
9	Barcelona	10.87%	24.36%	0.45
10	Munich	5.46%	12.48%	0.44
11	Rotterdam	2.30%	5.45%	0.42
12	Marseilles	4.11%	9.76%	0.42
13	Lisbon	8.24%	20.45%	0.40
14	Antwerp	3.74%	9.90%	0.38
15	Dusseldorf	4.49%	12.23%	0.37
16	Vienna	4.33%	11.88%	0.36
17	Berlin	11.31%	37.66%	0.30
18	Paris	2.87%	9.84%	0.29
19	Madrid	6.67%	23.00%	0.29
20	Brussels	2.79%	9.83%	0.28
21	Oporto	6.06%	25.58%	0.24
22	Stockholm	3.34%	16.51%	0.20
23	Copenhagen	2.13%	13.73%	0.15
24	Milan	1.40%	14.50%	0.10
25	Lyons	0.88%	12.27%	0.07

## Appendix 2

### Initial regression output

	Coefficient	Std Error	t-Statistic	Probability
Beta	-0.147	0.009	-1.38	0.18
Constant	-0.0016	0.004	-0.38	0.70
R-squared	0.08			
Adjusted R-squared	0.03			
SE of regression	0.19			
F-statistic	1.91			
Prob. F-statistic	0.18			
DW statistic	2.02			