Changes in the Relative Importance of Sector and Regional Factors: 1987-2002

by

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Abstract:

A stylised fact in the real estate portfolio diversification literature is that sector (property-type) effects are relatively more important than regional (geographical) factors in determining property returns. Thus, for those portfolio managers who follow a top-down approach to portfolio management, they should first choose in which sectors to invest and then select the best properties in each market. However, the question arises as to whether the dominance of the sector effects relative to regional effects is constant. If not property fund managers will need to take account of regional effects in developing their portfolio strategy.

We find the results show that the sector-specific factors dominate the regional-specific factors for the vast majority of the time. Nonetheless, there are periods when the regional factors are of equal or greater importance than the sector effects. In particular, the sector effects tend to dominate during volatile periods of the real estate cycle; however, during calmer periods the sector and regional effects are of equal importance. These findings suggest that the sector effects are still the most important aspect in the development of an active portfolio strategy.

Keywords: *sector and regional effects, dummy variable regressions, time series changes*

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Introduction

A stylised fact in the real estate portfolio diversification literature is that sector (property-type) effects are relatively more important than regional (geographical) factors in determining property returns. Thus, for those portfolio managers who follow a top-down approach to portfolio management, they should first choose in which sectors to invest and then select the best properties in each market. However, the question arises as to whether the dominance of the sector effects relative to regional effects is constant. If not property fund managers will need to take account of regional effects in developing their portfolio strategy.

In order to analyse the relative importance of sector and regions in determining property returns previous studies have used the dummy variable approach of Heston and Rouwenhorst (1994, 1995). Specifically, the studies use simple dummy variables to identify the sector and regional affiliation of each property. When these dummy variables are regressed on the cross-section of property returns, the estimated coefficients on the dummy variables are the implicit, or "pure", return effects of the sectors and regional factors. Four studies have applied this approach to the real estate market; Fisher and Liang (2000), Lee (2001), Newell and Keng (2003) and Andrew et al (2003). Fisher and Liang (2000) found that sector effects were more important than regional diversification, based on quarterly data from the US. Using UK data Lee (2001) found that the pure sector effects accounted for the majority of the variance in property returns, with the pure sector effects being more than twice as large as the pure regional-specific effects. In contrast, Newell and Keng (2003) find that the results for Australia do not support the previous work with the "pure" regional factors showing marginally greater effect than the sector-specific effect. Finally, using a much larger database and a longer time period Andrew et al (2003) found that although the dominance of the sector effect is generally robust across different periods of the property cycle, there were a number of periods when the regional factor was greater than the sector effect, especially in periods of market calm. In contrast, in periods of market turbulence the sector effects tended to dominate. This implies that the variation in importance between the two factors is changing through time. As a consequence, we need to investigate this issue in greater depth in order to see whether the regional factors have gained in importance relative to the sector factors.

In order to investigate whether the sector effects are more important than regional effects all of the time or whether the regional factors are of equal or greater importance for some of the time this paper uses monthly data over the period 1987:1 to 2002:12. In this way we can track the evolution in the relative importance of the sector and regional effects more closely overtime. Specifically, we distinguish between three kinds of factors: a national effect that captures broad co-movement across property returns, in effect controlling for the property cycle; pure sector-specific effects that control for property-type determinants of property returns; and regional-specific effects, which reflect the

different characteristics of the local market. In general, we find that although the sector-specific factors dominate for the vast majority of the time there are a few periods when the regional factors are of equal or greater importance. In particular, the sector effects tend to dominate during volatile periods of the real estate cycle, however, during calmer periods the sector and regional effects are of equal importance. These findings suggest that the sector effects are still the most important factor in the development of an active portfolio strategy.

The paper is organized as follows. Section 2 discusses the data, while Section 3 reviews our empirical approach. Section 4 presents the results. Section 5 concludes the study.

Data

It is important that the data used in this study is a realistic and unbiased representation of the performance of property in the UK. The databases of Investment Property Databank (IPD) provide such a source. IPD are a commercial organisation providing independent performance measurement and benchmarking services to property investors. Their databases are made up from individual property data supplied by contributing investors. These include insurance companies, pension funds and quoted property companies. Of particular interest in this study are those properties that are valued monthly and for which monthly performance figures are recorded. These properties form the dataset from which IPD's *UK Monthly Index* is constructed. Those funds that have monthly valuations of their property portfolios are generally either Property Unit Trusts (PUTs) or Managed Funds, both of which are required to have monthly valuations by UK law. The monthly dataset is a subset of the annual databank, but has a slightly different sector and regional composition. This is because these funds do not tend to hold large portfolios of properties and so do not invest in properties with a large lot size, such as Shopping Centres. In total, at the end of December 2002 the monthly index was based on the performance of 2,484 properties with an aggregate value of £11.6 billion from 53 funds (IPD, 2003).

The data used in this study is essentially all the standing investments in the monthly dataset described above. Standing investments are properties that are held in portfolios and not bought or sold, or subject to development or significant improvement expenditure during a particular period. However, properties that did not belong to one of the three main sectors (retail, office and industrial) were excluded from the analysis. These were typically properties in such sectors as agricultural land, residential property and leisure, which do not form a significant part of most institutional investment portfolios.

The analysis was run from the first month of 1987 (the first period in which monthly data is available) through to the last month of 2002, 192 months in all. Over this period, the number of properties covered varied, with around 1,000 properties in the early months, later rising to around 2,500 towards the end of the period. Despite this, the sector and regional composition remains relatively stable from month to month, with little deviation from the average proportions shown in Table 1.

Table 1: Average Sector and Regional Proportions: 1987 to 2002

Sector		Region	
Retail	**53%**	**London**	**18%**
Office	**27%**	**South East**	**35%**
Industrial	**20%**	**Rest of UK**	**47%**

The low frequencies in the early periods place a restriction on the classification of properties into sectors and regions. Thus, the analysis is kept to three sectors; retail, office and industrial and three super-geographical regions; London, the rest of the South East and the rest of the UK. The use of three super-regions suggested in previous studies by Eichholtz et al (1995) and Lee and Byrne (1998). In addition, this has the advantage that on average the sector and region portfolios are of equal size. Thus, we mitigate any potential bias against finding important regional effects induced by more refined regional classifications compared with sector portfolios that are larger and therefore more diversified (see Griffin and Karolyi, 1998). While, Andrew et al (2003) showed that the use of more refined regional classifications makes no significant difference on the results from the 3-by-3 sector regional scheme adopted here[1].

Methodology

Following Heston and Rouwenhorst (1994, 1995), we assume that the return on each property depends on four components: a national factor (α), sector factors (β) and regional factors (γ) and a property-specific disturbance (ε). The paper estimates a time-series for the realization of the common national factor, sector factors and regional factors by running the following cross-sectional regression every month from 1987:1 to 2002:12: using the following equation:

$$R_i = \alpha + \sum_{j=1}^{M} \beta_{i,j} F_j + \sum_{k=1}^{L} \lambda_{i,k} F_k + \varepsilon_i \qquad (2)$$

where:

R_i	= the return of property i in time period t	i = 1,....N
α	= the return on the market in general	
β_j	= the return to the sector factor j	j = 1,.....M
λ_k	= the return to the regional factor k	k = 1,....L
F_j	= 1 if the property is in sector j, 0 otherwise.	
F_k	= 1 if the property is in region k, 0 otherwise	

Equation (1) cannot be estimated in its present form because it is unidentified due to perfect multicollinearity. Intuitively, this is because every property belongs to both a region and a sector, so that region and sector effects can be measured only relative to a

[1] All the handling and processing of individual property data was done by IPD to maintain investor confidentiality.

benchmark. One possibility would be to arbitrarily choose one region in one sector as a base, and estimate equation (1) under the restriction that this sector and region are zero.

Rather than apply such an arbitrary sector/regional choice, Morgan (1964), Sweeny and Ulveling (SU) (1972), Suits (1984) and Kennedy (1986) have all introduced proposals for presenting the results of a regression when there are one or more qualitative variables. Morgan (1964) illustrated the transformation for a single dummy variable with three classes using a hypothetical problem. SU extended the approach of Morgan to several dummy variables as well as explanatory variables. Suits (1984) and Kennedy (1986) present a similar transformation to that of SU. All authors suggest that once a restricted version of equation (1) is estimated the coefficients of the deleted sector and region can be recovered by adding a constant to each of the estimated sector and regional coefficients and subtracting the sum of the two constants from the intercept α. Where the constants to be added and subtracted are the proportions of the data in each sector j and region k.

This approach simplifies the interpretation of the coefficients but does not affect the statistical properties of the model (see Suits, 1984) and Kennedy, 1986). The intercept α reflects the return on the equal-weighted portfolio of the sampled property across the UK - a benchmark against which sector- and regional-specific effects are measured. Because (1) is estimated month-by-month, α will vary over time, capturing the impact of the UK property cycle on property returns across sectors and regions. Thus, the estimated sector and regional coefficients represent excess returns relative to this return. As long as no two sectors in the sample have exactly the same proportion of properties across the regions there is no identification problem in estimating these regionally neutralised sector effects and sector-neutralised regional effects simultaneously.

We follow the literature in using different metrics to quantify the importance of sector and region effects. First we follow Rouwenhorst (1999) in using mean absolute deviations (MADs) of the sector and region coefficients from equation 1. We report the equal-weighted average for the three sectors and three regions to compare the relative importance of the sector and regional effects. The sector MAD can be interpreted as the average tracking error for returns on region-neutral sector portfolios relative to returns on the benchmark portfolio. The regional MAD has an analogous interpretation. We then consider the ratio of these average sector effects to the average regional effects as a measure of the relative importance of the sector factor relatively to the regional factor (Cavaglia et al, 2000). Intuitively, the implication of the MADs for portfolio managers is as follows. If the ratio is greater than one the return of a portfolio that is not diversified across sectors will on average deviate from the benchmark more than a portfolio that is not diversified across regions.

For the second metric we follow Heston and Rouwenhorst, 1995 and compute the estimated variances of the "pure" region and sector effects from equation (1). In addition, we also report the equal-weighted averages of these variances to compare the relative importance of the sector and regional effects. The higher the variance of sector (region) effects, the higher the proportion of the variability in excess returns explained by

sector (region) factors. More intuitively, if the variability of sector effects is higher than that of regional effects, portfolio managers can achieve more reduction in risk by diversifying across sectors than by diversifying across regions.

Finally we follow Beckers et al (1996) and compare the explanatory power of the individual factors, as measured by adjusted R^2, in determining property returns relative to that of the full model including all factors. The difference in the cross-section of explanatory power measures the contribution of the omitted variable to explaining individual property returns in a given period t.

Overall Results

We first discuss the time-series excess coefficients of the sector and region effects. Table 2 gives these values for the individual sectors and regions and for the absolute composite sector and region effects over the full sample period, January 1987 to December 2002, and for four-year sub-periods in Panel A. The interpretations of the coefficients are, as outlined above, the impact on a property returns of each factor (sector and region) net of common national effects. For example, the coefficient for offices in Period 1 (2.05%) indicates that investment in an equal weighted portfolio of office properties, diversified across the UK out-performed by 2.05% per annum compared with the average return of the equal weighted UK property portfolio. In contrast, in Period 2 investment in an equal weighted office portfolio under-performed the UK average by 3.75% per annum. In a similar way, if the coefficient for South East property in Period 1 (-0.44%) is considered it suggests that investment in an equal weighted portfolio of retail, offices and industrial properties diversified across the South East under-performed on average by 0.44% compared with the UK market in general and continued to do so in every sub-period year up to and including 2002. Overall the coefficients in Table 2 show that the 'best' portfolio to hold in Period 1 would have been a portfolio in the industrials, over-weighted in London. In contrast the 'best' portfolio to hold in Period 2 would have been invested industrials, over-weighted in the Rest of the UK. This shift in composition largely reflects cyclical influences specifically the difference in timing of both business and real estate cycles across the UK.

When we compare the overall absolute average of the sector coefficients (1.51) to that for the regional coefficients (0.42), we find a ratio of 3.6:1, which is considerably higher than that found by Andrew et al (2003) (1.4:1) using annual data. However, the dominance of the sector effects is not constant. The sector effects dominate in the first and last sub-periods, both periods of market volatility, while the regional effects dominate in the second and third sub-periods, periods of relative calm. This suggests that sector effects are more important in determining property returns in periods of market boom and bust, whereas sector and regional effects are of equal importance in periods of market calm.

Next we discuss the variances of the sector and regional factors shown in Panel B of Table 2. These results show a number of features of interest. First, there is a wide divergence in variances across sectors even after controlling for the common national factor and the "pure" regional factor. The office and industrial sectors showing the

greatest variance and retails the least. Second, the variability of the regional factors is generally lower than that of the sector effects, except for the London region. Indeed, the London region has the highest variance overall and often shows a greatest variance in the various sub-periods of any sector or region. For instance, in the first sub-period the London regions variance (40.63% squared) was much greater than that of industrials and retails and only marginally less than that of offices. This confirms the view that the London region needs to be considered as a separate property market in its own right (see Cullen, 1993 and Hamelink et al, 2000 and Andrew et al, 2003). Third, Table 2 shows that sector effects on average have been more variable than region effects over the full sample period. The ratio of the composite sector effects variance (15.76%-squared) to the composite region effects variance (9.25%-squared) is about 1.7:1. This result is similar to that of Lee (2001) (2:1) but less than that found by Andrews et al (2003) (3:1). Fourth, the four-year sub periods in Table 2 show that the composite variances of the sector and region effects have changed considerably overtime. Sector effects are the most variable at the beginning (1987-1990) and at the end (1999-2002) of the sample. Regional effects are the most variable in the period of the sample (1987 and 1990) but have not risen at the end of the sample as the sector effects.

Table 2: Decomposition of Annualised Property Returns into Sector and Regional Factors 1987:1 - 2002:12

	87:1-90:12	91:1-94:12	95:1-98:12	99:1-02:12	87:1-02:12
Panel A Coefficients	**Period 1**	**Period 2**	**Period 3**	**Period 4**	**Full Period**
Sectors					
Retail	**-3.41**	**1.04**	**-0.42**	**-0.84**	**-0.91**
Office	**2.05**	**-3.75**	**-0.24**	**0.56**	**-0.34**
Industrial	**6.88**	**2.74**	**1.71**	**1.81**	**3.29**
Absolute Average	**4.11**	**2.51**	**0.79**	**1.07**	**1.51**
Region					
London	**1.05**	**-3.98**	**2.45**	**1.77**	**0.32**
South East	**-0.44**	**-1.03**	**-0.45**	**-0.21**	**-0.53**
Rest UK	**0.03**	**2.55**	**-0.45**	**-0.48**	**0.41**
Absolute Average	**0.51**	**2.52**	**1.12**	**0.82**	**0.42**
Panel B Variances	**Period 1**	**Period 2**	**Period 3**	**Period 4**	**Full Period**
Sectors					
Retail	**18.08**	**2.32**	**0.69**	**5.61**	**9.24**
Office	**41.39**	**7.52**	**2.33**	**10.10**	**19.88**
Industrial	**34.18**	**13.07**	**2.64**	**4.90**	**18.16**
Sector Average	**31.22**	**7.64**	**1.89**	**6.87**	**15.76**
Regions					
London	**40.63**	**5.58**	**3.20**	**6.33**	**20.36**
South East	**5.60**	**2.38**	**1.20**	**0.39**	**2.48**
Rest UK	**9.84**	**2.11**	**0.57**	**0.85**	**4.91**
Regional Average	**18.69**	**3.35**	**1.66**	**2.52**	**9.25**
Panel C Adjusted R^2	**Period 1**	**Period 2**	**Period 3**	**Period 4**	**Full Period**
Sector	**1.37**	**1.28**	**0.22**	**1.64**	**1.13**
Region	**0.16**	**0.65**	**0.19**	**0.33**	**0.33**

Finally, Panel C of Table 2 shows that the sum of the explanatory power of the sector and regional dummies is very small. On average the sector effects account for only 1.2% and the regional factors only 0.3% of the variability of monthly returns in the UK. This is much smaller that that found by Andrew et al (2003), 5% for the sector factors and 3.7% for the regional effects using annual data. This suggests that other variables are of greater importance than sector and regional classification in determining property returns. Nonetheless, when we compare the explanatory power of the sector-specific factors to that of the regional effects, the adjusted R^2 values of the sectors are always greater than those of the regions. For the sector effects the adjusted R^2 values are highest in Period 4 and least in Period 3, whereas the adjusted R^2 values for the regional factors is highest in Period 2 and least in Period 1.

The Evolution through time of the Sector/Regional Effects

The results above represent the average relative influences of sector and regions between January 1987 and December 2002. However it is very likely that these relative influences are evolving through time. More precisely, the regional factors may have gained in importance relative to the sector factors. To test this hypothesis, we compute the 2-year moving average of the average sector effects and of the average regional effects for two of the three metrics, the MADs and variances. We then consider the ratio of these average sector effects to the average regional effects as a measure of the relative importance of the sector factor relatively to the regional factor. Thus, a ratio greater than one means that in period t sector effects dominate regional effects, the opposite is true if the ratio is smaller than one. The choice of a 2-year period results form the trade-off between using a shorter period that could lead to a lack of statistical power, and using a longer period, which could excessively smooth the data.

Figure 1 plots of the sectors and regions MADs and the MAD of the national factor. The national factor MAD shows the broad co-movement across property returns, in effect representing the property cycle. As is clearly seen the late 1908s and early 1990s was a period of a major boom and bust in the performance of property in the UK. This was then followed by a minor boom and bust from 1993-1996. This in turn was followed by a much longer period of average performance that ended in 2001, since which time the UK property market has seen another short rise.

Figure 1 shows that in line with the results in Table 2 the magnitude of sector MADs has changed over time. The two-year average of the sector MADs at the beginning of the sample measures 5.72% per annum (in absolute terms). This number then rises with the boom in the property market in general to peak at 7.99% per annum (in absolute terms) in February 1990 and then gradually falls back to a low of 1.03% per annum (in absolute terms) in January 1998. The sector factor MADs then hovers between 1 and 3% per annum until the end of the sample in December 2002 (2.01%), which is significantly below the initial estimate. The pattern for region MADs is similar but almost always less than the sector effects, consistent with the results in Table 2. The two-year average of the region MADs at the beginning of the sample is 3.57% per annum (in absolute terms) and then between 3.5% and 1% until the end of the sample.

Figure 2 takes a more direct look at the relative importance of the sector and region effects. It plots the two-year moving average of the ratio of sector to region variances. Consistent with Figure 1 the ratio of the sector variances relative to the regional variances is always greater than one except for the period from September 1993 to June 1996 and again from June 1997 to May 1999. Figures 3 and 4 for the sector and regional variances tell a similar story.

5. Conclusion

The benefits of sector and regional diversification in property portfolios have been well documented in the literature. However, the question arises as to whether the dominance of the sector effects effect relative to regional effects is constant. In order to investigate whether the sector effects are more important than regional effects all of the time or whether the regional factors are of equal or grater importance for some periods this paper uses monthly data over the period 1987:1 to 2002:12 for a sample of over 1000 properties. In this way we can track the evolution in the relative importance of the sector and regional effects over time. Taken together the results presented in Table 2 and Figures 1-4 show that the sector-specific factors dominate the regional-specific factors for the vast majority of the time. Nonetheless, there are periods when the regional factors are of equal or greater importance to the sector effects. In particular, the sector effects tend to dominate during volatile periods of the real estate cycle; however, during periods of relative calm in the UK property market the sector and regional effects are of equal importance. These findings suggest that the sector effects are still the most important aspect in the development of an active portfolio strategy.

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Figure 1: Moving Average National, Sector and Regional MADs

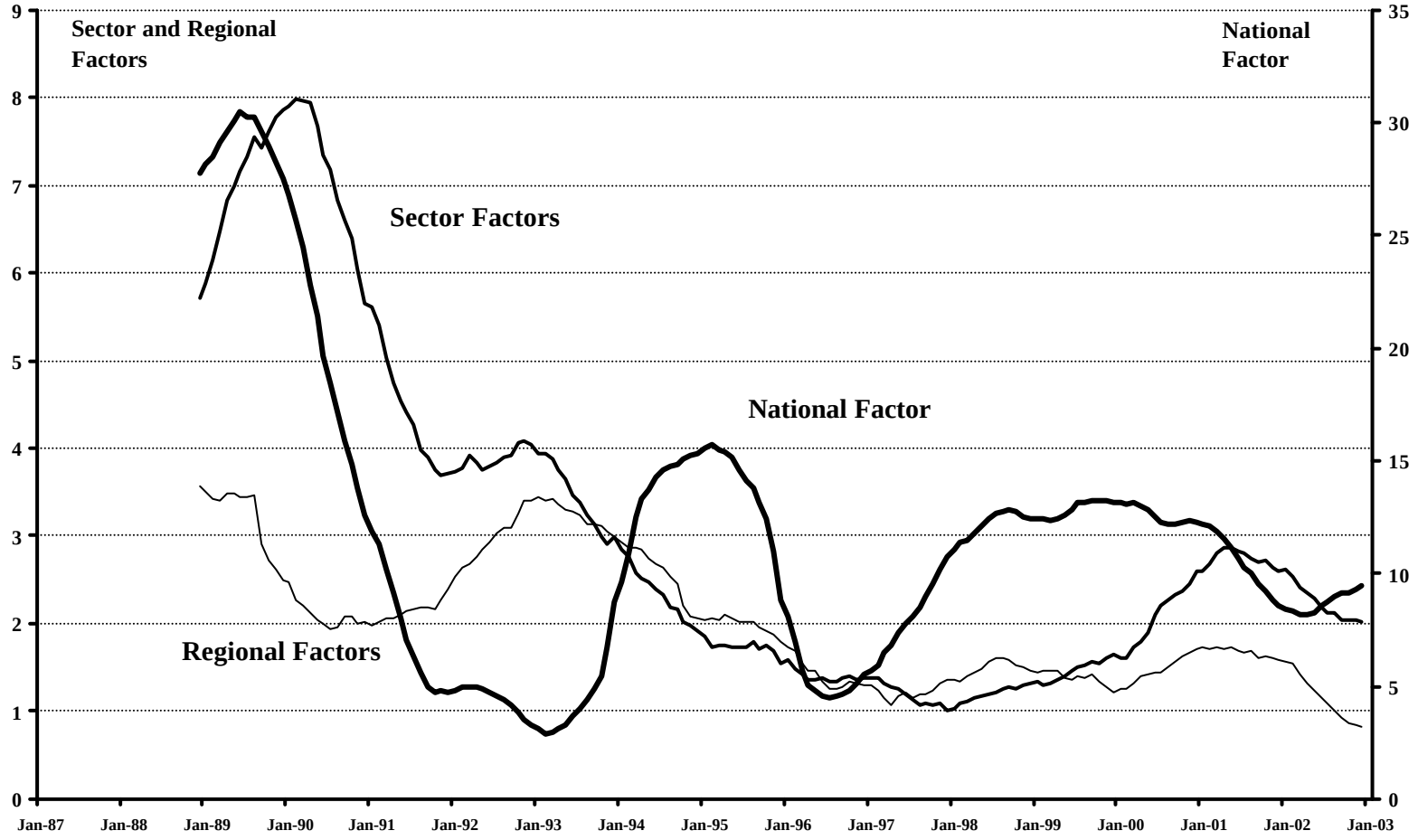

Figure 2: The Ratio of Sector to Regional MADs

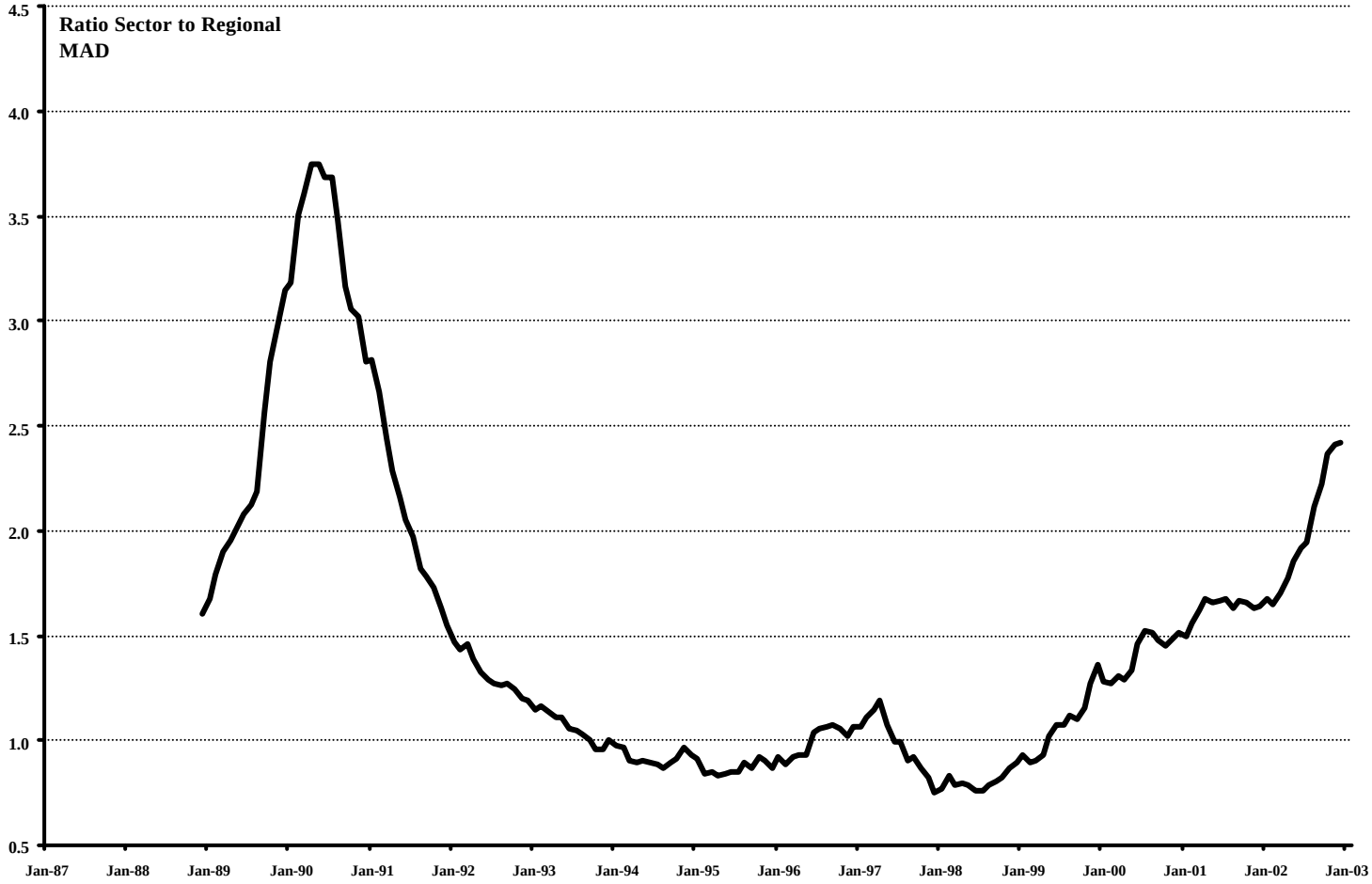

Figure 3: Moving Averages of Sector and Regional Variances

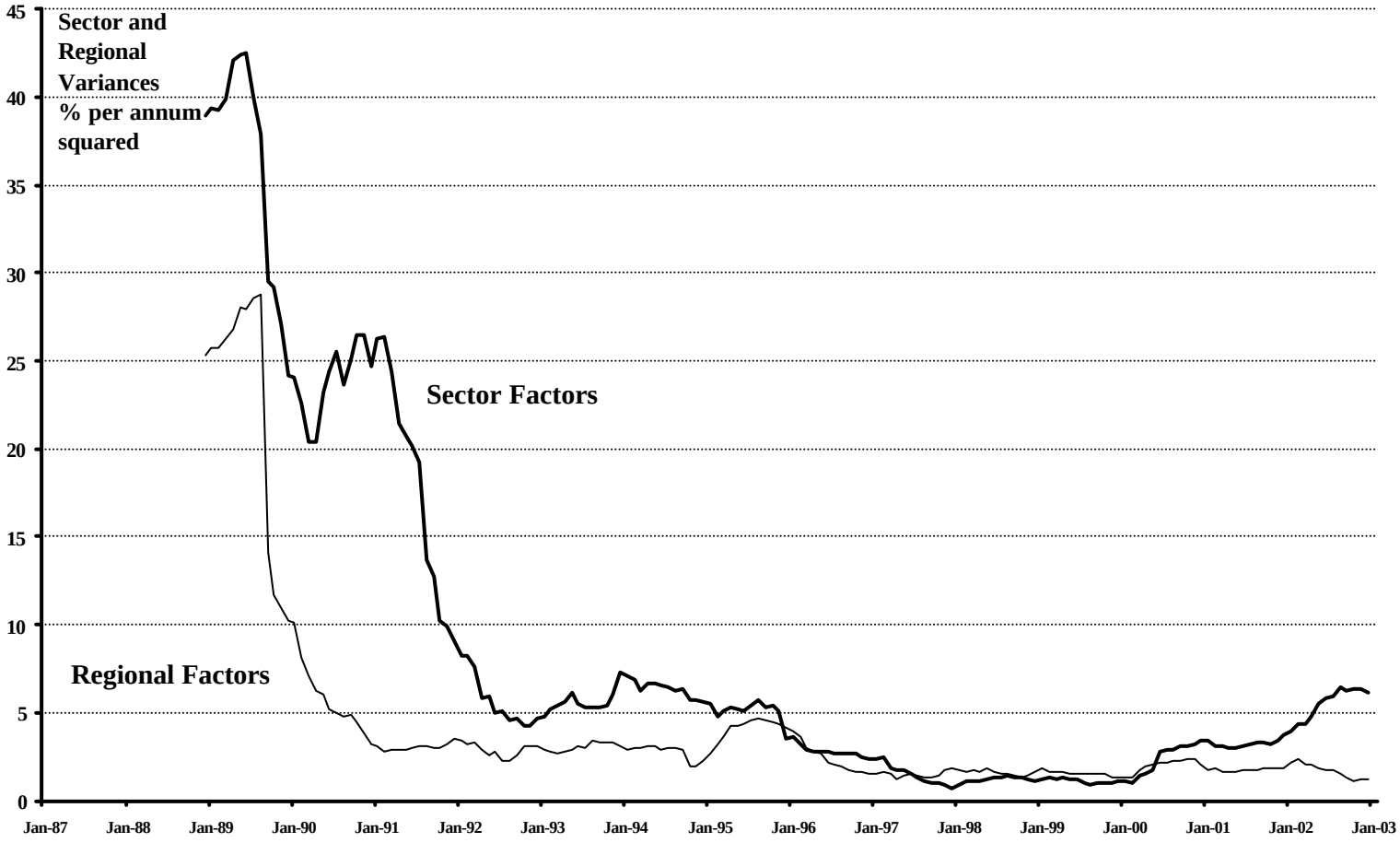

Figure 4: The Ratio of Sector to Regional Variances