Regional UK House Price Co-Movement

William Miles
Dept. of Economics
Wichita State University
1845 Fairmount
Wichita, KS 67260-0078
Ph: 316-978-7085
Fax: 316-978-3308
E-mail: william.miles@wichita.edu

Abstract

Cyclical synchronization of home prices has important implications for monetary (and other) policies. Regional house price divergence, even over a business cycle, can inhibit labor mobility and prevent workers from moving to where they could add most to their own wages and overall growth. We study house price co-movement across the different UK regions with a method, that, unlike previously employed techniques, allows for time-varying estimates. We find first, that the UK exhibits more home price divergence compared to previously reported results for the US. Second, regions near London exhibit the most co-movement, and those further from London the most divergence. Third, London itself is in the "middle of the pack" in terms of synchronization compared to other regions. This may reflect London's status as a "global city" and being the destination for housing demand from sources abroad. Lastly, segmentation has clearly been increasing, rather than decreasing in recent years.

Keywords: R3 Real Estate Markets; R31 Housing Supply and Markets; R1 General Regional Economics; E3 Prices, Business Fluctuations and Cycles.

Introduction

The degree to which house prices in different regions exhibit a high level of cyclical co-movement could be important to a number of stakeholders, such as lenders or portfolio managers seeking to forecast home values. If home values in Wales and West Midlands exhibit a high degree of coherence, changes in the former could help predict changes in the latter, and vice-versa. In addition, the extent of cyclical co-movement has implications for monetary policy. While the Bank of England does not formally target housing, home values could have a large impact on the macroeconomy through wealth effects and their impact on financial institution balance sheets. Indeed, in the United States, housing has been demonstrated to be *the* leading indicator of the business cycle (Leamer, 2007, 2015). Thus, the Bank of England has an interest in home price movements. And a lack of co-movement makes policy difficult. If such prices are rising in Outer Metro, but falling in Scotland, optimal policy for the latter would be loose, while that for the former would be tight. A high level of cyclical co-movement among home values in different regions would help make the UK more of an "optimal currency area".

Moreover, if house prices diverge across regions, even over the business cycle, they can inhibit the optimal migration of workers. If, say London is booming while Yorkshire and Humberside are in recession, workers from Y&H would naturally seek opportunities in the UK capital. However, if housing costs in London are much higher than in Y&H, workers may forego moving to areas with greater job opportunities. Ganong and Shoag (2017) show that in the US, output convergence has stalled in recent decades after a century during which incomes across different states had been moving closer together. They point to divergent home values as a culprit. The authors demonstrate that relatively low-skilled workers living in cheaper US regions are currently better off not moving to expensive areas such as New York City in search of jobs, as the higher housing costs in NYC make real, housing-adjusted wages lower there than in cheaper cities. And this was not the case in decades past, when home values were not so markedly different across the US.

There has been much research on house price co-movement among the UK regions. This research has tended to focus on two topics. First, whether there is a "ripple effect" between regions. That is, does an increase in home values in the southeastern portion of the UK get transmitted to other regions? Secondly, do home values across the UK converge to a single long run level? The focus of this study is on co-movement at the business cycle frequency.

Towards that end, we employ a method developed by Mink, Jacobs and DeHaan (2012). This technique has two advantages over others used in the literature. It yields time-varying estimates, so we obtain not just a sample-wide average of co-movement but can also observe the evolution of synchronization through the years. The other advantage is that one of these measures accounts not just for differences between regions in the phase of the cycle (are house prices in two regions both expanding or is one growing while the other contracts) but also differences in amplitude. This is important, as two regions that are in the same cyclical phase could still have very different cycles. One region, for instance could be in a mild contraction while another was experiencing a severe housing downturn. While the most desired monetary policy would be loose for both regions, it would optimally be much looser for the latter than the former.

Our results indicate the UK housing market displays a high degree of segmentation, compared to previous results found for the United States. We also find that this segmentation has increased in recent years. Regions closest to London appear to exhibit the greatest co-movement, while those further away and further north tend to have more idiosyncratic home values. In addition, although regions near London exhibit a high level of cohesion, the city itself is in the "middle" of the regions in terms of synchronization, rather than being highly synchronous. This may be owing to London's receipt of capital flows from abroad, it being a global city. These flows may be related to political developments in other countries (Badarinza and Ramadorai, 2018) and hence might not be related to housing or other developments in the UK.

This paper proceeds as follows. The next section describes the previous literature. The third explains our data and methodology. The fourth describes our results, and the fifth section concludes.

Previous Literature

The thirteen UK regions have provided researchers with an interesting data set with which to investigate regional house price co-movement. As noted, in the case of the UK, there have been two main strands in the literature. The first studies whether a ripple effect exists, or whether house price changes in one part of the UK (usually London or the South East) ripple out to other UK regions. MacDonald and Taylor (1993), Cook and Thomas (2003) and Cook (2016) are three of many examples. Results are mixed, with some studies finding a ripple effect, while others, such as that by Ashworth and Parker (1997) cast doubt on its existence. A somewhat related paper is by Holly, Pesaran and Yamagata (2011). These authors use a panel model and find that shocks to London affect other UK regions, and that London house prices are affected by those in New York City in the US.

The second strand of the literature concerns whether house prices in the different UK regions converge to a single, long run level. As with the results on the ripple effect, a consensus has not yet emerged from these studies so far. Drake (1995) examined the UK regions using the Kalman filter. He found substantial differences in UK house prices by region. The North and Scotland in particular showed substantial divergence from the south, and thus there was little evidence for overall convergence. On the other hand, Cook (2003) examines the ratios of each of the regional house price indices to the national UK house price index. In these studies, the stationarity of these ratios would indicate national convergence in home values.

Alexander and Barrow (1994) examine the different UK regions with bivariate Johansen cointegration tests and are able to reject the null hypothesis of no long-run relationship in a majority of cases. In contrast, Cook (2005) tests for cointegration among the regions using a nonlinear method that allows for asymmetric adjustment, and finds stronger evidence for convergence. Holmes and Grimes

(2008) have an innovative approach, in which they take the first principal component of the different regional/national ratios, and test the component for stationarity. Rejecting the null of nonstationarity, as the authors do, bolsters the case for convergence. Alternatively, Abbott and DeVita (2013) make several criticisms of the previously employed methods, and instead use the pair-wise approach of Pesaran (2007). These authors find little evidence for convergence. Cook (2012) finds evidence for convergence over certain sub-samples of the available data.

While the ripple effect and convergence have been the subject of numerous papers, the cyclical co-movement of house prices is the frequency most likely influenced by monetary policy. Gray (2019) examines co-movement among the housing markets of the UK, Northern Ireland and Ireland, but does so at the medium-term, rather than business cycle frequency. We thus examine the business-cycle co-movement of UK house prices with a method that improves on some previously-used techniques.

Data and Methodology

The thirteen regions of the UK are East Anglia, East Midlands, London, North, North West, Outer South East, Outer Metro, Northern Ireland, Scotland, South West, Wales, West Midlands and Yorkshire and Humberside. The data on house prices comes from the Nationwide Building Society (at https://www.nationwide.co.uk/about/house-price-index/download-data). The data is quarterly, and spans 1973:4-2019:2. The indices are seasonally adjusted. They are not adjusted for inflation, however; all measures employed are between regions at a point in time, thus we do not adjust for the price level.

Previous methods of measuring synchronization between economic variables entailed a metric based on correlation. Rose (2008) stated business cycle synchronization "is typically (though not always) measured as a correlation coefficient that is estimated between de-trended levels of activity for countries i and j over some reasonable period of time" (p. 6). Mink, et al. (2012) argue that a measure only based on correlation "does not adequately take into account that output gaps can have different signs and/or have a different amplitude" (p. 218).

As an example of papers on house price co-movement that did not take account of differences in both correlation and amplitude, Beltratti and Morana (2010) examined international house price co-movement across G-7 nations. The authors use a factor-augmented vector autoregression (FAVAR) model. While the authors can obtain measures of the extent to which home price fluctuations in one country are affected by those in others, there is no distinction made between differences in phases of cycles and differences in the volatility of fluctuations. Moreover, no possible changes in co-movement over the sample, which spans 1980:1-2007:2, are investigated. DeBandt, Barhoumi and Bruneau (2010) look at house price interactions for Australia, France, Germany, the UK and the US. They, like Beltratti and Morana estimate interactions with a FAVAR. The same difficulties of interpretation for Beltratti and Morana thus exist for Debandt, et al.'s results.

Hirata, Kose, Otrok and Terrones (2012) also apply factor analysis to the estimation of house price co-movement among eighteen countries. However, the authors also utilize a concordance index, which was developed by Harding and Pagan (2002) and is close in concept to one of the measures-synchronicity-that we will employ. While not accounting for differences in amplitude, the authors do attempt to examine changes in co-movement over time by splitting their sample. Their first sample period runs from 1971:1-1984:4, and their second from 1985:1 to 2011:3. The authors make this distinction based on the perceived greater effect of globalization in the latter period compared to the former. They find evidence of higher house price co-movement over the latter, more globalized period than before.

Miles (2017) examines the same eighteen countries using the method of Mink, et al. and finds, contrary to the results of Hirata, et al. that house price co-movement among these eighteen countries does not appear to have increased. The Mink et al. method thus seems appropriate to apply to the oft-studied interaction of house prices across the UK regions.

This method entails first obtaining the cyclical portion of a series-in this case home prices in each of the thirteen regions. Like Mink, et al., we employ the Christiano-Fitzgerald band-pass filter to decompose each index into a trend and cyclical component. As is standard, we extract cycles of between two and eight quarters. The cycle in a given quarter is divided by its trend to yield the "gap" for an index (for quarter t, the gap for region i is $g_i(t)$). The measures of Mink, et al. require a reference gap. There are options as to the choice of reference-one could pick a "dominant" region, but the choice of region may not be clear. We thus follow Mink, et al. and use the median gap as the reference, which is denoted as $g_r(t)$.

The first measure of cyclical co-movement is called synchronicity, and is computed thusly:

$$\varphi_{ir}(t) = (g_i(t)g_r(t))/(|\, g_i(t)g_r(t)|) \quad (1)$$

This is calculated for each country. It takes a value of one if both the region and the median are in the same phase of the cycle-both growing or both contracting. It is equal to minus one if the region and median are in opposite cycle phases.

Mink, et al. also created an aggregate measure of synchronicity for all regions:

$$\varphi(t) = (1/n) \sum_{i=1}^{n} (g_i(t)g_r(t))/(|\, g_i(t)g_r(t)|) \quad (2)$$

This metric takes values ranging from a low of zero to a maximum value of one, which it reaches when all regions are in the same cyclical phase.

The synchronicity metrics are an improvement on previous measures of cyclical synchronization. One key advantage is that they are calculated for each period (in this study each quarter). However, synchronicity measures cannot capture differences in the volatility, or amplitude of cycles. Two regions could be in the same phase-say a contraction. But the first region could be in a mild downturn, while the other may be in a severe contraction. In terms of monetary policy, both regions would benefit from central bank easing. But the latter region would optimally have much looser policy than the former (see Figure 2 in Mink, et al. on page 221 for an illustration of the importance of controlling not just for differences in the phases but also differences in the amplitude of cycles).

Thus, in addition to synchronicity, Mink, et al. created a measure called similarity, which captures differences in cyclical amplitude. For a given region, similarity at quarter t is

$$\gamma_{it}(t) = 1 - (|\, g_i(t) - g_r(t)|) / \sum_{i=1}^{n} |\, g_i(t)|/\mathrm{n} \qquad (3)$$

This measure can hit a low of 1-n, and a high of one. As was the case with synchronicity, there is an aggregate measure of similarity for all regions in a sample:

$$\gamma\,(t) = 1 - (\sum_{i=1}^{n} |\, g_i(t) - g_r(t)|) / \sum_{i=1}^{n} |\, g_i(t)|) \ (4)$$

As Mink, et al. describe, this aggregate similarity measure can take a minimum value of 2-n and a maximum value of one. In the latter case, house prices in all regions would be having an identical cycle.

Lastly, Mink, et al. test for changes in their similarity measures by regressing, for each region (each eurozone country, in their case) similarity on a constant and trend, and testing for a structural break with the Andrews-Ploberger method. This method of testing for change is better than the approach of Hirata, et al. (2012) who split the sample at a point in which they surmised the impact of globalization had increased. This leads to the endogenous break problem; testing based on a date of known change leads to often erroneous inference. The chosen date is based on prior knowledge and its use as a break point may inflate a test statistic even when no change has occurred (see Hansen (1992) for a discussion). The Andrews-Ploberger test, in contrast, allows for endogenously determined breaks. We will thus apply this method to the UK regions.

Results

Table 1 displays the averages for synchronicity for each region over the 1973:4-2019:2 sample. The overall aggregate synchronicity measure has a mean of 0.481295. There is a very wide range among the different regions. Northern Ireland's individual synchronicity only averages 0.005464, while that for Outer Metro has the highest average value at 0.672131.

For similarity, Table 2 shows the average value of the aggregate measure is 0.216506. As was the case with synchronicity, this overall measure incorporates a wide variation across the regions. Northern Ireland again has the lowest value of -0.59218, while Outer South East rather than Outer Metro, has the highest average similarity with a value of 0.561453 (although Outer Metro has the second highest mean similarity value).

One notable aspect of these results is that, by the standards of previous works, the UK housing market does not appear convergent. Miles (2015) examined house price co-movement in the US with the Mink, et al. technique. While the time series samples and the number of regions differ between the two countries (nine in the US versus thirteen for the UK) the co-movement measures in the US appear higher than those for the UK. For instance Miles (2015) finds an overall average value of synchronicity of 0.6253 in the US (as opposed to the corresponding value of 0.481295 we find here for the UK), and a range of 0.4464 to 0.764, while our results for the UK displayed in Table 1 show a range of 0.005464 to 0.672131.

Differences in similarity tell a "similar" story. Miles found overall similarity had a mean value of 0.346 for the US regions, while we find a much lower corresponding value of 0.216506 for the UK. Miles found the range of similarity in the US was from -0.1593 up to 0.64. Table 2 shows our findings for this range in the UK are from -0.59218 to 0.561453. Miles concluded there was a low level of integration for the US housing market; there thus appears to be an even lower level of integration for housing in the UK.

In terms of which regions exhibit the most (or least) cyclical co-movement, Outer South East and Outer Metro have the two highest levels of average synchronicity and similarity. Although the correspondence isn't exact, for the most part, regions closest to London exhibit the most co-movement, and those furthest from the UK capital the least. One can further discern that the more northern regions of Scotland, Northern Ireland, North, and Yorkshire and Humberside show less co-movement with the overall national housing market, on average, than the more southern regions. This likely reflects the long-established (and by some measures, growing) North-South divide.

Interestingly, London itself is the "median" region-ranking seventh out of thirteen in terms of both synchronicity and similarity. This is actually consistent with some previous research. Alexander and Barrow (1994) found that "the South East (rather than greater London) acts as an exogenous determinator for other regions in the south" (p. 1667). While much economic activity occurs close to London, the city itself, being a "global city", may be highly affected by shocks arising outside the UK that may not impact surrounding regions as much. For instance, Badarinza and Ramadorai (2018) find London house prices are affected by foreign purchases of housing, as the city is seen as a safe haven from political turmoil or violence abroad. The authors find house prices in the city are predicted by political events in Russia, the Middle East and elsewhere. Other regions near the city, while exhibiting a high level of co-movement with the national market, may not be viewed as safe havens to the same extent of London.

An examination of the synchronicity and similarity graphs (Figures 1 through 15) indicates that housing coherence has declined in recent years. While the regional graphs for synchronicity are not displayed for brevity of exposition (but are available upon request), Figure 1 shows that there has been a pronounced decline in aggregate synchronicity starting from 2009. Its values since that year indicate a housing market in which regions were less often in the same cyclical phase than in prior years.

This result is bolstered by the findings on similarity (Figures 2 through 15). For the individual regions, East Midlands, North West, Outer South East, Scotland, South West and West Midlands display no visible changes in their fluctuation patterns after around 2000. On the other hand, London and five of the other regions that display lower overall similarity (Table 2) exhibit a marked decrease in similarity at varying times, since 2000. London itself exhibits a structural break using the Andrews-Ploberger test (Table 3) at 2003:4. After this break point, similarity actually rises, and has a bit of a positive "streak" before falling palpably in 2013.

The North region has a break at 1996:1, after which it also has fairly high values for a time, but similarity shows a clear drop in 2005. Northern Ireland exhibits no significant break, but similarity falls and remains below its previous values starting in 2006. Wales, displayed in Figure 13, had a significant break at 1998:4, a time of a "local" peak, but starting from the mid-2000s similarity displayed a notable downward trend. Finally, Yorkshire and Humberside display a significant change at 2004:3, also around a "local maximum" but starting around 2010 exhibit more negative values than usual. It appears that the last ten to fifteen years have been witness to a decline in co-movement for the UK housing market, with the decreased level of coherence coming mostly from those regions primarily further north and further from London.

The lower co-movement is further demonstrated by Figure 2, showing overall similarity. Just as with the synchronization measure, overall similarity displays a notable decline into lower values in recent years. As shown in Table 3, there is a significant break at 2002:1. And since 2003, there has been a marked decline. Thus not only does the UK housing market display a low level of overall co-movement, what co-movement has existed is declining.

Conclusion

Housing markets in the UK display substantial segmentation, even compared to those of the United States, which themselves have been shown to exhibit a high degree of local idiosyncrasy. For housing policy, this suggests that if any interventions are desirable, they are likely best tailored to local conditions rather than being national in scope.

In terms of macroeconomic policy, these findings make monetary policy, to the extent it has an impact on the broader economy through housing, a less effective tool. Given questions about the overall effectiveness of monetary policy in recent years, in a time of zero (and in some cases negative) policy rates, fiscal policy may thus be more desirable. Fiscal policy can also be more readily targeted toward local conditions, which, for the UK housing market can be very divergent.

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Table 1
Synchronicity Averages

Region	
Outer Metro	0.672131
Outer SE	0.672131
W. Midlands	0.639344
S. West	0.628415
E. Anglia	0.551913
E. Midlands	0.530055
London	0.530055
Wales	0.497268
North	0.42065
N. West	0.398907
Scotland	0.398907
Y&H	0.311475
N. Ireland	0.005464
Overall	0.481295

Table 2
Similarity Averages

Region	
Outer SE	0.561453
Outer Metro	0.499449
N. West	0.444445
W. Midlands	0.366806
E. Midlands	0.315953
S. West	0.315901
London	0.246408
Scotland	0.21944
E. Anglia	0.195912
Y&H	0.106732
Wales	0.105832
North	0.028427
N. Ireland	-0.59218
Overall	0.216506

Table 3
Break Test Results

Region	Break Date	P-Value
E. Anglia	2012:3	0.0026
E. Midlands	1989:4	0.3364
London	2003:4	0.0032
N. Ireland	1996:3	0.3442
North	1996:1	0.0039
N. West	1993:4	0.0004
Outer Metro	2010:3	0.4661
Outer SE	1992:1	0.5742
Scotland	1987:2	0.0038
S. West	1986:2	0.4163
Wales	1998:4	0.0054
W. Midlands	1981:2	0.025
Y&H	2004:3	0.0118
Overall	2002:1	0.000

Results are based on Andrews-Ploberger Max. statistic. P-values are for the null hypothesis of no significant break.

Figure 1
Overall Synchronicity

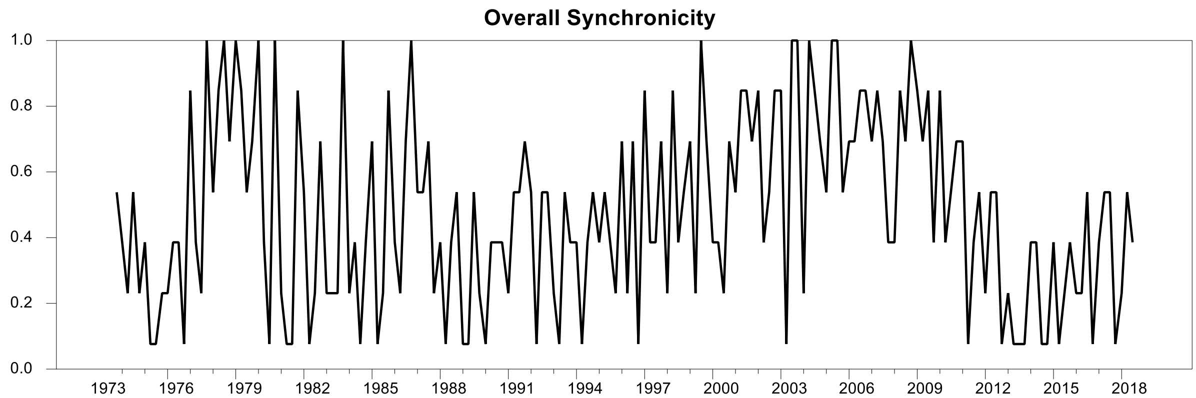

Figure 2
Overall Similarity

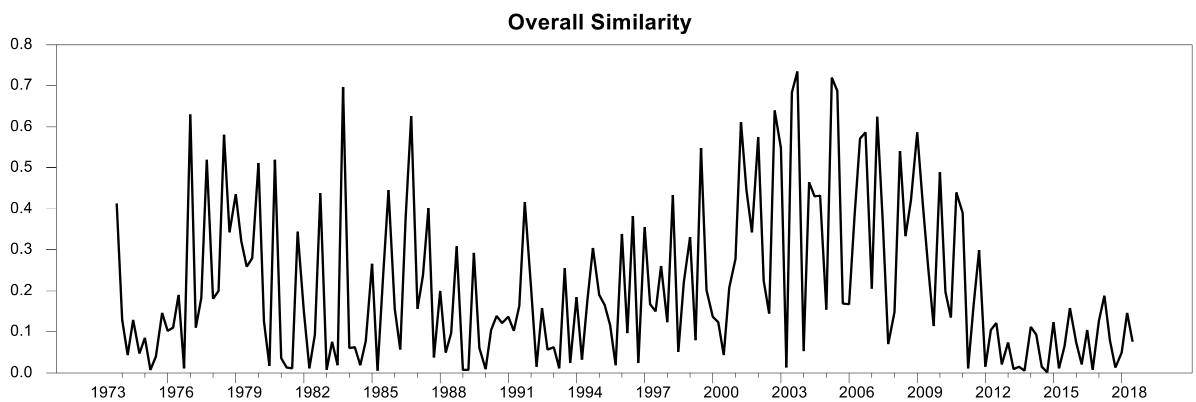

Figure 3
East Anglia Similarity

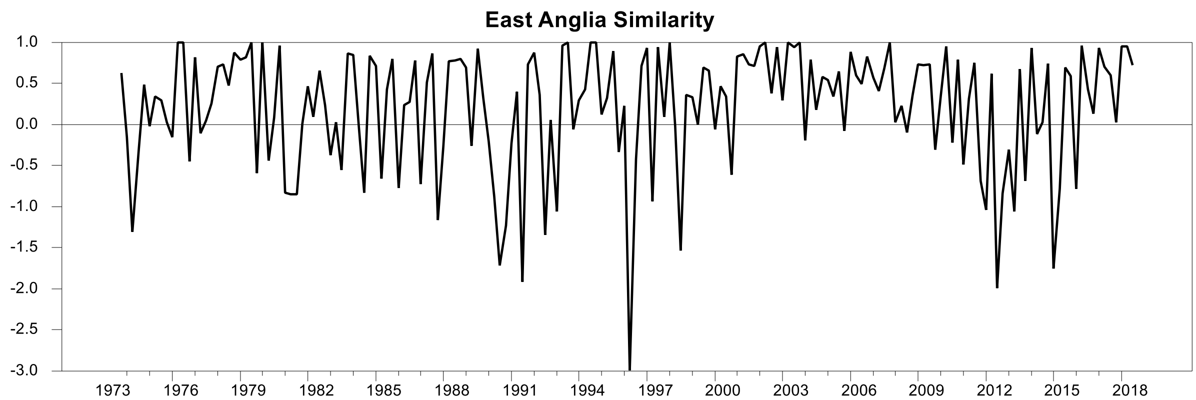

Figure 4
East Midlands Similarity

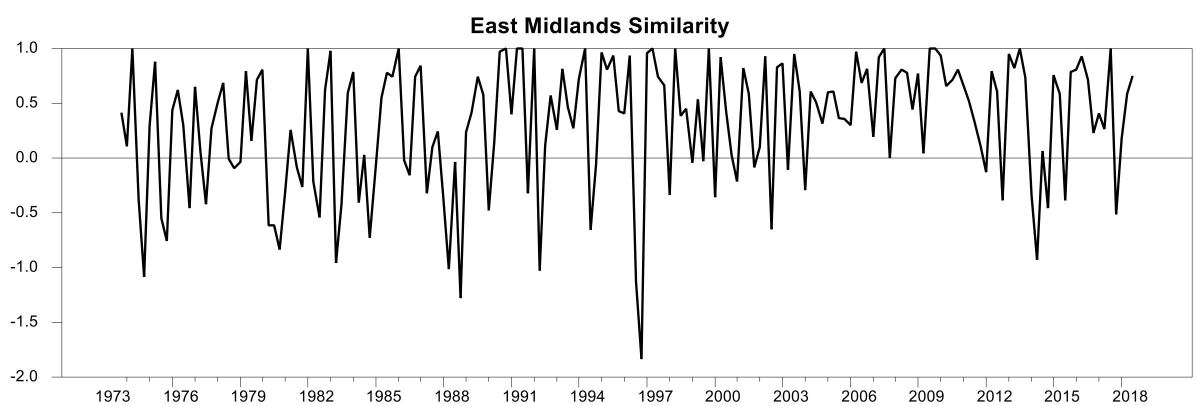

Figure 5
London Similarity

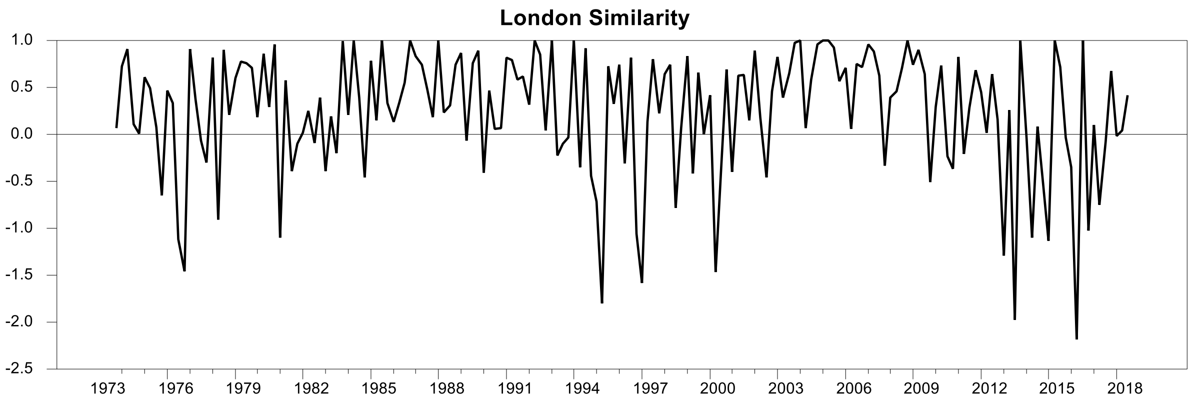

Figure 6
North Similarity

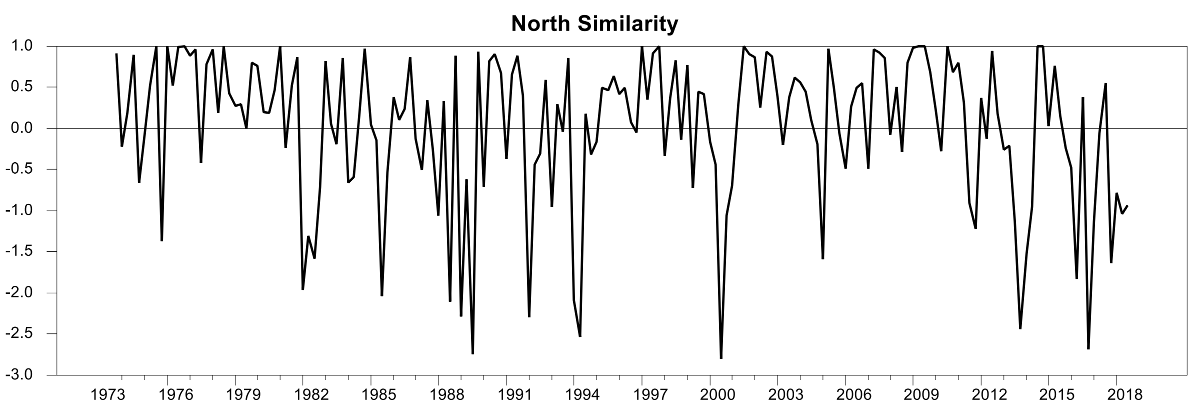

Figure 7
Northern Ireland Similarity

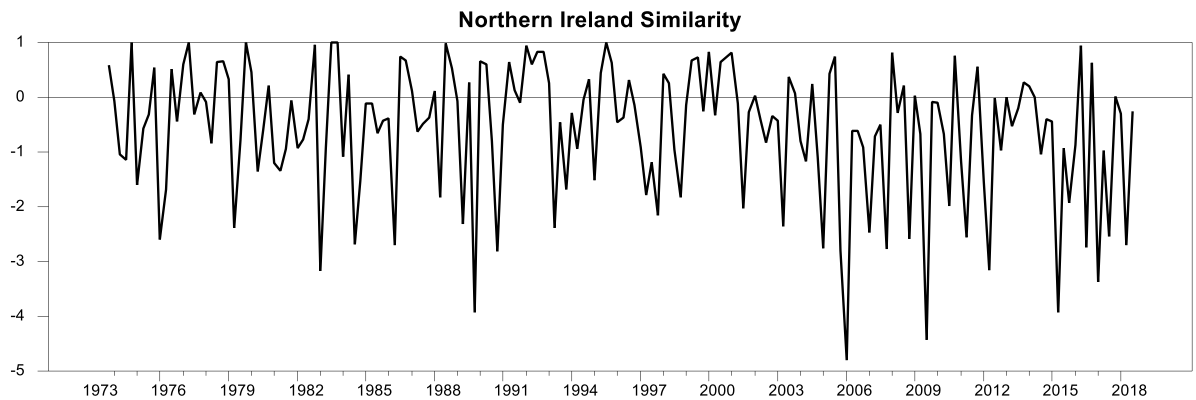

Figure 8
Northwest Similarity

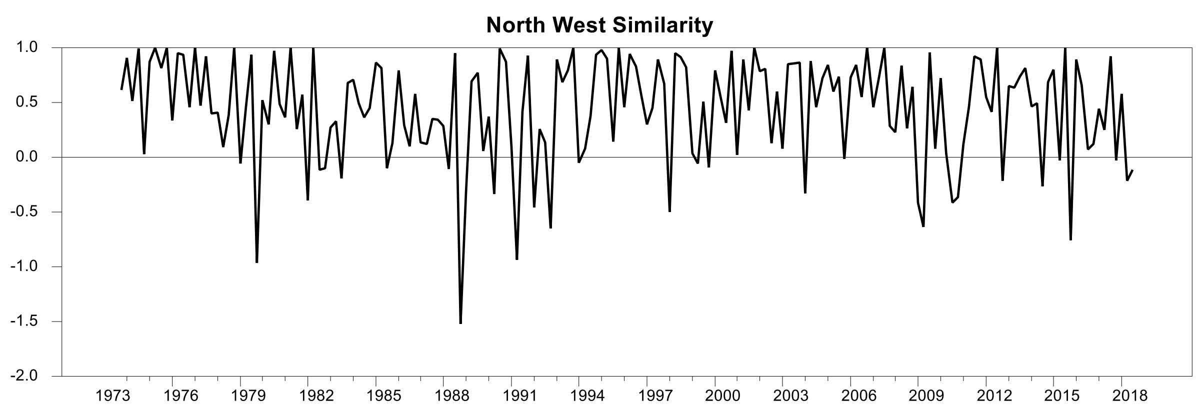

Figure 9
Outer Metro Similarity

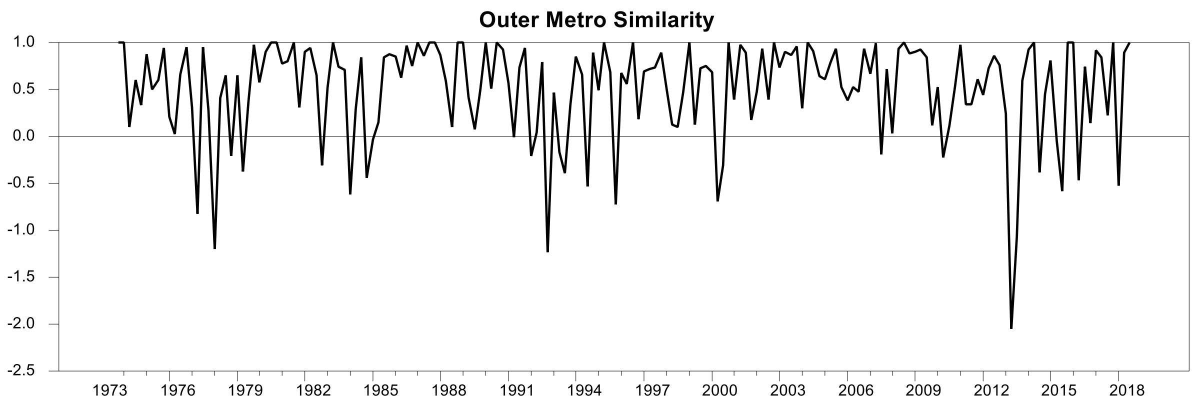

Figure 10
Outer South East Similarity

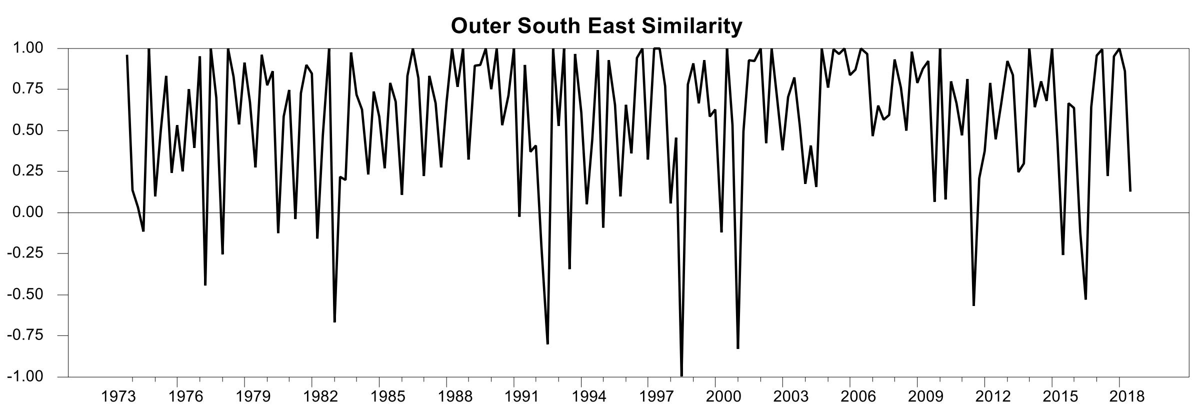

Figure 11
Scotland Similarity

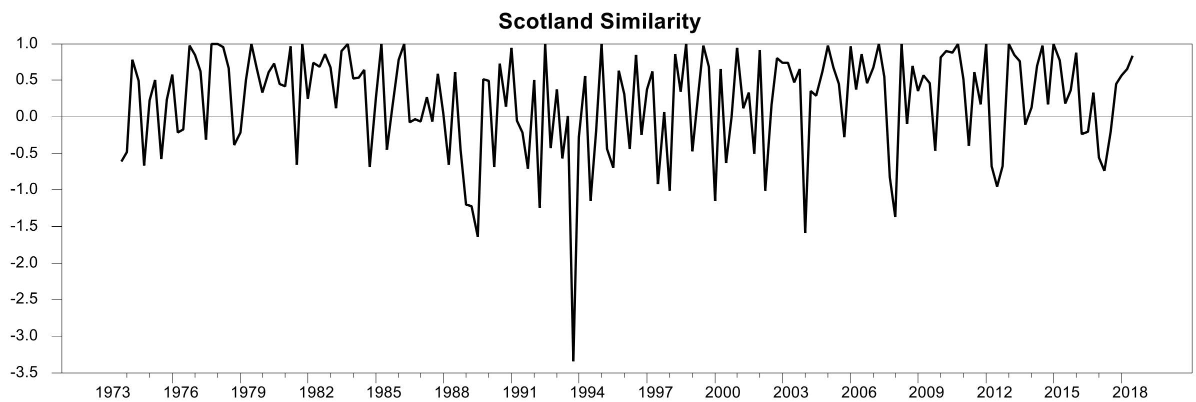

Figure 12
South West Similarity

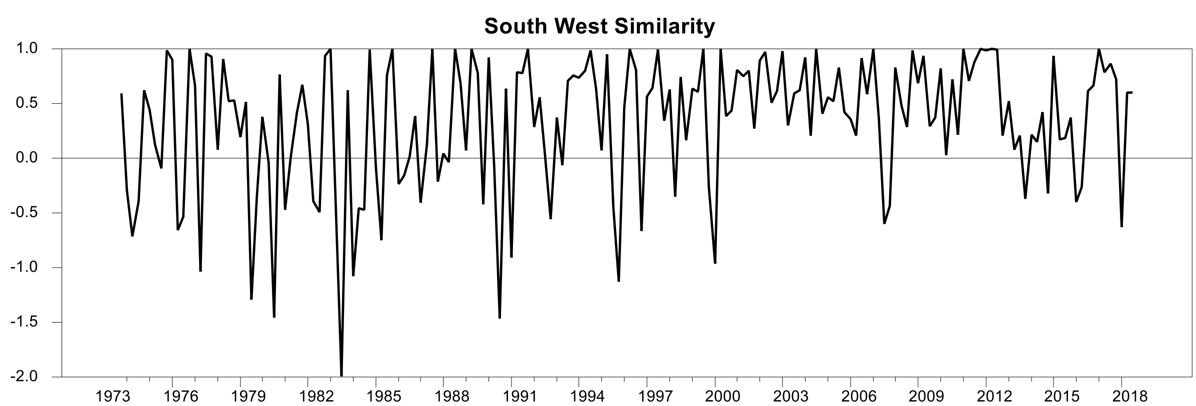

Figure 13
Wales Similarity

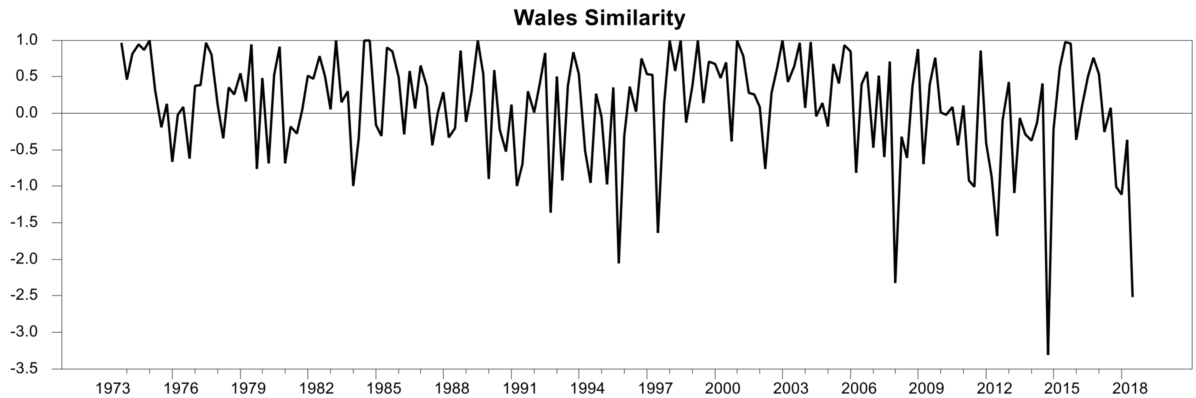

Figure 14
West Midlands Similarity

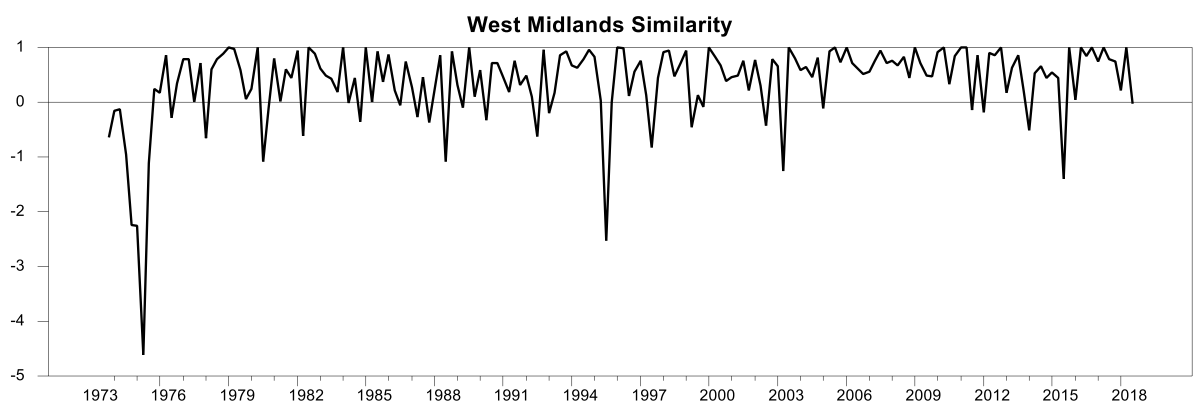

Figure 15
Yorkshire and Humberside Similarity