Return & Volatility Spillovers: Regional Office & Retail Market Connectedness

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Integration v Diversification

Economic integration and regional connectedness within countries may imply limited opportunities for investment portfolio diversification.

Previous research on UK office markets has identified similarities between regions in relation the sensitivity of rent to demand and supply side factors (Hendershott *et al.*, 2002).

Furthermore, Attanasio *et al.*, (2009) note that there may be some form of common causality that links regions therefore leading to significant correlations.

However, regions vary in value added and as indicated by Stevenson *et al.*, (2014), the performance of real estate assets is driven by economic fundamentals more so than in the case of capital markets.

While international investment may deliver portfolio diversification, the fact that real estate investment is highly concentrated in a small number of key cities whose economies are often underpinned by the financial sector, may result in renewed interest in, and a re-examination of, investment opportunities in regions within a given country.

Literature

Srivatsa and Lee (2012) examine β and σ convergence in rents and yields of European office markets over the period 1982 – 2009.

Using rental data, Amsterdam, Frankfurt and Madrid showed evidence of β-convergence to the EU average after EMU.

There was stronger evidence of convergence in yields in Core European markets – Amsterdam, Brussels, Frankfurt, Paris both before and after EMU.

London less convergent with Europe, S&L suggesting it was more greatly exposed to global financial factors.

Shiller (1998) suggests that, instead of carefully analysing macroeconomic fundamentals, investors predict market performance by observing performance of the same investment category in other regions.

Investors may focus too much on what is happening in similar regions, instead of collecting evidence on fundamentals that, in turn, can result in information spillovers and spatial interdependence among regions with similar economic conditions.

Literature

Antonakakis et al. (2018) examine the connectedness of the UK regional housing returns using a dynamic measure of connectedness developed by Diebold and Yilmaz (2014).

Overall, their findings indicate that the transmission of inter-regional property returns shocks is an important source of regional property return fluctuations.

What is more, this is a dynamic, event-dependent process which implies that, over time, any UK region can be both a net transmitter and a net receiver of shocks.

Literature

Liow and Schindler (2017) examine linkages between office markets in Europe using the generalised spillover index of Diebold and Yilmaz (2012)

They find time varying significant volatility spillovers across leading office markets.

London offices were a ‘volatility leader’ with significant spillovers to other European office markets

Their finding of volatility spillover cointegration implies the presence of unobserved common shocks that might undermine international investors’ diversification strategies

Approach

In this presentation we examine office markets in UK regions and the six main regional cities in the UK, after London.

First, we provide evidence of the extent to which regional real estate markets and economies are correlated.

Second, we adopt a generalised vector autoregressive approach to capture return and volatility spillovers.

Third, following the research developed by Diebold and Yilmaz (2012, 2014) we employ variance decomposition analysis to find the share of each city's (region's) own variance to itself and to other cities (regions).

Finally, we establish whether relationships are stable or time varying and therefore the extent to which diversification benefits may still exist.

Methodology

Consider a covariance stationary N-variable VAR(p) with independently and identically distributed disturbances that have a moving average representation.

From the MA terms we can split the forecast error variances of each variable related to system shocks.

The variance decompositions let us find the proportion of the forecast error variance in x_i due to shocks to x_j

H step ahead forecast error variance:

$$\varphi_{ij}(H) = \frac{\sigma_{jj}^{-1} \sum_{h=0}^{H-1} \left(e_i' A_h \Sigma e_j\right)^2}{\sum_{h=0}^{H-1} \left(e_i' A_h \Sigma A_h' e_i\right)}$$

Where Σ is the variance matrix of the error vector, σ_{ij} is the standard deviation of the error term for j^{th} equation, A_h is an $N \times N$ coefficient matrix, and e_i is a selection vector with 1 as the i^{th} element, zero otherwise.

Spillover Indices: Total Connectedness

The own and cross-variable variance contribution shares do not aggregate to 1 under the generalised decomposition, hence each entry of the variance decomposition matrix is normalised by its row sum:

$$\tilde{\varphi}_{ij}(H) = \frac{\varphi_{ij}(H)}{\sum_{j=1}^{N} \varphi_{ij}(H)} \text{ with } \sum_{j=1}^{N} \tilde{\varphi}_{ij}(H) = 1, \text{ and } \sum_{j=1}^{N} \tilde{\varphi}_{ij}(H) = N$$

The total connectedness or spillover index measuring the contribution of connectedness from shocks from all other sectors to the total forecast error variance is:

$$TC(H) = \frac{\sum_{i,j=1, i \neq j}^{N} \tilde{\varphi}_{ij}(H)}{\sum_{j=1}^{N} \tilde{\varphi}_{ij}(H)} \times 100$$

$$= \frac{\sum_{i,j=1, i \neq j}^{N} \tilde{\varphi}_{ij}(H)}{N} \times 100$$

Spillover Indices: Directional Connectedness

Directional Connectedness received by region *i* from all other regions *j* is measured as:

$$DC_{i \leftarrow j}(H) = \frac{\sum_{i,j=1,j\neq i}^{N} \widetilde{\varphi}_{ij}(H)}{\sum_{j=1}^{N} \widetilde{\varphi}_{ij}(H)} \times 100$$

$$= \frac{\sum_{i,j=1,j\neq i}^{N} \widetilde{\varphi}_{ij}(H)}{N} \times 100$$

Directional connectedness from regions *i* to all other regions *j* is:

$$DC_{i \rightarrow j}(H) = \frac{\sum_{j=1,j\neq i}^{N} \widetilde{\varphi}_{ji}(H)}{\sum_{i,j=1}^{N} \widetilde{\varphi}_{ji}(H)} \times 100$$

$$= \frac{\sum_{j=1,j\neq i}^{N} \widetilde{\varphi}_{ji}(H)}{N} \times 100$$

Net connectedness can be found for each region by subtracting $DC_{i \leftarrow j}$ from $DC_{i \rightarrow j}$

Office & Retail Total Return Spillovers 2002q2-2018q3

Spillover (Connectedness) Table

	tro_bir	tro_bri	tro_man	tro_lee	tro_gla	tro_edi	tro_cty	tro_we	From Others
tro_bir	14.2	11.7	9.6	12.9	14.6	15.0	11.1	11.0	85.8
tro_bri	13.6	12.5	9.9	11.9	14.4	15.3	11.5	11.0	87.5
tro_man	12.9	12.0	11.1	10.3	14.8	13.8	12.8	12.2	88.9
tro_lee	15.0	11.4	9.0	14.5	13.9	16.1	10.1	10.0	85.5
tro_gla	11.9	11.3	10.7	10.3	17.0	13.9	12.1	12.9	83.0
tro_edi	12.2	12.3	9.9	10.7	15.0	17.4	11.5	10.9	82.6
tro_cty	11.6	11.5	10.8	9.0	15.8	14.2	14.6	12.5	85.4
tro_we	11.8	11.3	11.3	9.6	16.0	13.7	13.1	13.3	86.7
Contribution to others	89.0	81.6	71.1	74.7	104.6	101.9	82.0	80.6	685.4
Contribution including own	103.2	94.1	82.2	89.2	121.5	119.3	96.7	93.8	85.7%

Spillover (Connectedness) Table

	trr_bir	trr_bri	trr_man	trr_lee	trr_gla	trr_edi	trr_lo	From Others
trr_bir	15.1	16.0	14.1	17.6	9.8	10.4	17.0	84.9
trr_bri	13.9	16.5	13.9	16.6	10.5	11.5	17.0	83.5
trr_man	13.8	15.3	14.6	16.6	11.3	11.6	16.8	85.4
trr_lee	15.3	15.4	13.9	18.6	10.2	10.1	16.5	81.4
trr_gla	14.2	15.2	14.0	18.2	11.1	10.7	16.7	88.9
trr_edi	13.2	16.2	13.9	16.7	10.2	12.4	17.4	87.6
trr_lo	13.4	16.3	13.8	17.1	10.4	11.2	17.9	82.1
Contribution to others	83.7	94.3	83.6	102.8	62.4	65.4	101.5	593.7
Contribution including own	98.9	110.8	98.2	121.4	73.5	77.8	119.4	84.8%

Office & Retail Total Return Volatility Spillovers 2002q2-2018q3

Spillover (Connectedness) Table

	tro_bir	tro_bri	tro_edi	tro_gla	tro_lee	tro_man	tro_cty	tro_we	From Others
tro_bir	21.2	19.9	6.4	15.7	16.0	13.4	3.8	3.4	78.8
tro_bri	15.8	22.3	10.4	16.6	14.1	9.0	6.8	5.0	77.7
tro_edi	8.2	16.8	28.8	23.4	5.5	3.9	7.0	6.4	71.2
tro_gla	10.5	13.5	13.1	24.9	8.5	7.8	11.2	10.6	75.1
tro_lee	21.1	19.6	4.4	12.6	24.0	12.8	3.4	2.1	76.0
tro_man	20.7	17.6	4.4	14.3	17.6	15.7	5.5	4.2	84.3
tro_cty	7.6	12.9	18.6	19.4	6.4	5.9	17.8	11.5	82.2
tro_we	4.9	10.6	19.2	24.1	2.1	5.6	13.9	19.5	80.5
Contribution to others	88.8	110.9	76.6	126.1	70.3	58.4	51.6	43.2	625.8
Contribution including own	110.0	133.2	105.4	151.1	94.4	74.0	69.3	62.7	78.2%

Spillover (Connectedness) Table

	trr_bir	trr_bri	trr_edi	trr_gla	trr_lee	trr_lo	trr_man	From Others
trr_bir	19.5	9.5	12.4	7.0	24.5	16.0	11.1	80.5
trr_bri	15.5	12.6	15.1	6.7	21.4	18.2	10.6	87.4
trr_edi	12.6	6.9	24.8	7.4	22.4	20.7	5.3	75.2
trr_gla	14.9	5.3	16.0	12.1	30.3	16.0	5.6	87.9
trr_lee	19.2	6.9	12.5	6.7	32.5	15.5	6.7	67.5
trr_lo	6.5	3.1	13.5	5.3	24.4	43.6	3.7	56.4
trr_man	16.4	9.8	14.7	8.0	21.9	17.5	11.6	88.4
Contribution to others	85.1	41.5	84.1	41.1	144.9	103.8	42.9	543.4
Contribution including own	104.6	54.1	108.9	53.2	177.4	147.4	54.5	77.6%

Results Summary

For both return and volatility spillovers in retail and office markets, intra-regional connectedness explains the largest proportion of the forecast error variance as the diagonal elements have higher values than off diagonal elements, although in some cases not by much

However inter-regional connectedness is high at about 85% for return spillovers and 78% for volatility spillovers

London offices are less important than some regional markets in relation to return spillovers perhaps suggesting stronger connections between some regional markets than between London and the regions.

In contrast, there is more connectedness between London retail and regional retail markets.

Office Rental Value Growth Spillovers 1981 – 2017

Spillover (Connectedness) Table

	rv_cty	rv_mt	rv_we	rv_se	rv_sw	rv_ea	rv_em	rv_wm	rv_wa	rv_nw	rv_yh	rv_ne	rv_sc	From Others
rv_cty	16.3	16.8	17.3	12.9	3.5	12.8	1.6	1.5	0.2	2.6	0.8	4.8	8.9	83.7
rv_mt	13.7	14.7	16.6	11.7	5.1	14.2	2.6	1.8	0.1	1.9	2.1	5.9	9.5	85.3
rv_we	10.7	11.6	16.1	10.1	6.9	15.2	4.1	2.4	0.6	2.0	3.7	7.5	9.2	83.9
rv_se	11.2	12.2	13.4	20.1	4.3	14.9	1.8	5.7	0.7	0.2	0.5	6.9	7.9	79.9
rv_sw	0.2	0.4	0.8	2.0	18.2	8.8	17.4	9.7	0.2	12.6	17.5	0.9	11.2	81.8
rv_ea	6.2	8.2	9.4	11.8	9.5	15.8	8.4	7.0	2.2	0.7	5.3	2.8	12.7	84.2
rv_em	0.1	0.1	0.3	1.3	15.5	6.0	18.1	11.6	1.2	13.5	19.1	2.8	10.3	81.9
rv_wm	0.1	0.3	1.0	4.9	15.1	8.4	14.8	15.9	2.8	11.4	13.7	2.0	9.7	84.1
rv_wa	2.9	3.0	3.0	3.7	15.1	8.1	12.7	9.3	10.8	5.9	10.2	1.9	13.4	89.2
rv_nw	3.2	3.4	3.3	2.2	14.5	6.1	15.9	10.2	1.3	14.8	15.3	0.3	9.6	85.2
rv_yh	0.3	0.5	0.6	1.8	16.1	6.4	18.8	11.0	1.3	11.6	18.3	0.4	12.8	81.7
rv_ne	3.0	1.9	4.1	3.0	10.0	2.6	11.9	14.9	4.4	15.0	11.8	12.7	4.7	87.3
rv_sc	3.4	4.1	4.6	4.6	13.5	9.9	14.5	8.5	0.6	4.7	13.3	2.8	15.6	84.4
Contribution to others	55.2	62.5	74.3	70.1	129.1	113.3	124.6	93.5	15.7	82.1	113.2	39.0	120.0	1092.6
Contribution including own	71.5	77.2	90.4	90.2	147.3	129.1	142.7	109.4	26.5	96.9	131.5	51.7	135.6	84.0%

Using rental value growth, inter-regional connectedness is high at 84%

The first three markets are within central London – the West End is the only market where spillovers from the City and Mid Town markets are more important than intra-submarket connectedness

The spillovers from Central London are relatively small for other regions other than the East of England.

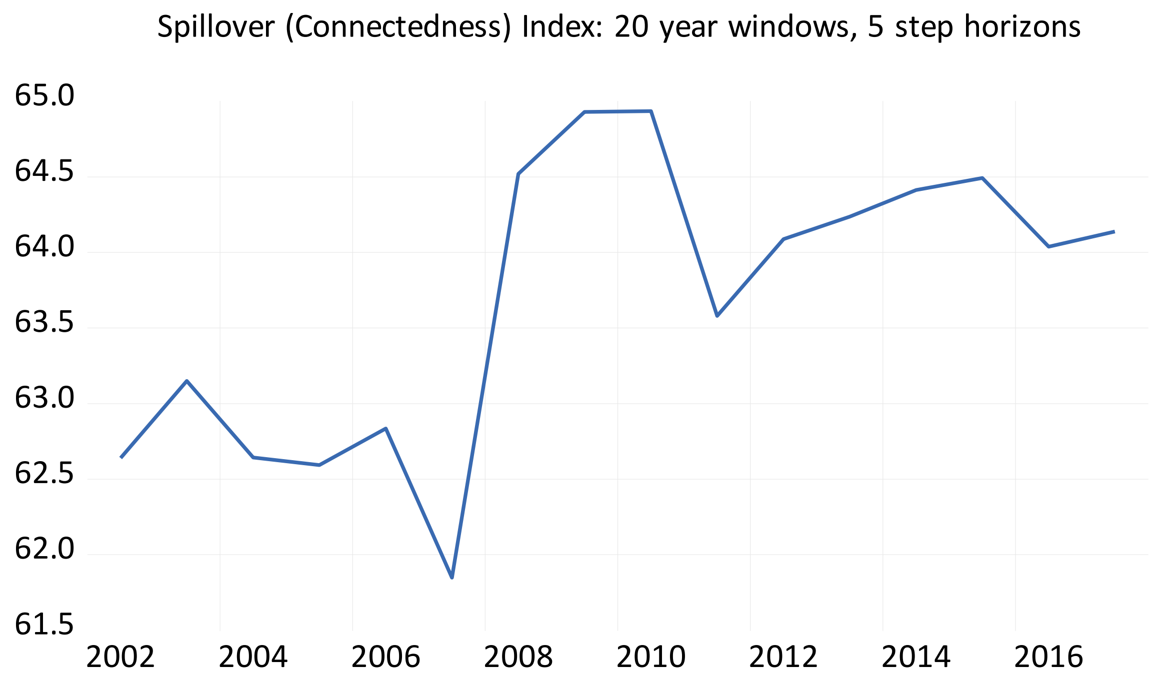
The South West, East Midlands, North West, and Yorkshire & Humberside have significant spillovers from other regional markets (outside London).

Office Rental Value Growth Spillovers

City of London

Midtown

West End



Conclusions

This study has shown a high degree of connection and spillovers between regional markets and urban commercial real estate markets across Britain.

London offices seem less connected to regions and regional cities perhaps reflecting the much greater important of international financial flows to the city and its status within the global office market hierarchy

Common causality seems to link regional economies reflecting similarities in economic base and broadly in value added from office service sector activities

Over time, spillovers seem to have increased since the GFC particularly within London office submarkets

Retail markets show more similarities across the country with London being perhaps more similar to other regional centres than was the case for London offices.