Do Foreign Buyers Compress Office Real Estate Cap Rates?*

PAT MCALLISTER, ANUPAM NANDA**

ABSTRACT

We investigate the relationship between the activity of foreign investors and capitalization rates in major European office markets. In the process, the paper provides a comprehensive analysis of the determinants of European office market capitalization rates. Using DTZ's Investment Transaction Database and data on a range of local sector-specific and macroeconomic variables across 28 key European cities over 1999-2013, we test several empirical hypotheses including potential endogenous determination of office capitalization rates and the level of foreign investment. A two-stage modelling exercise reveals that there is significant negative effect of foreign investment on office market cap rates. The results are robust across several model specifications and samples.

Keywords: Foreign investment, Capitalization Rate, Real Estate, Panel data.
JEL Classifications: F21, G15, R11, C33

*This research is supported by the DTZ Research Institute and is based on the databases provided by the DTZ Research Institute.
**_Corresponding author:_ Anupam Nanda, Henley Business School, University of Reading, Reading, RG6 6UD, UK. a.nanda@reading.ac.uk

1. INTRODUCTION

The growth of cross-border real estate investment in recent decades has generated increasing interest about its characteristics and impacts. An important market shift in this period has been the global transformation in the range and scope of real estate investment organisations and their third party service providers. In addition to fairly long established institutional investors such as occupational pension funds, insurance companies and listed real estate companies/trusts, other types of real estate investment organisations have become increasingly prominent. Sovereign wealth funds, specialist open and closed end real estate funds, investment banks, specialist real estate investment managers, private equity groups and endowment funds have emerged as significant market participants with a number of these organisations creating global operational platforms to execute international real estate investment strategies. Although there is little empirical evidence, foreign investors are frequently perceived to be affecting prices. This paper reports on research investigating the relationship between the activity of foreign investors in different European office markets and capitalization rates.

Compared to international equity flows, the patterns and effects of cross-border *direct* real estate investment have been the subject of limited research. Given relative data availability, the majority of published work has focussed on international real estate securities and their return determinants, diversification potential and currency risk (for examples see Eichholtz, Gugler and Kok, 2011; Ling and Naranjo, 2002; Worzala and Sirmans, 2003b; Bond, Karolyi and Sanders, 2003). Probably preceding large scale cross-border real estate investment, in the 1990s there emerged a body of survey research on the costs and benefits of international real estate investment (see Falkenback, 2009; Lizieri, 2009 and Worzala and Sirmans, 2003a for reviews). However, recent evidence indicates that cross-border capital flows between real estate markets have become increasingly important – albeit the Global Financial Crisis caused a fall in both intra- and inter-national real estate investment activity (see Lizieri, Reinert and Baum, 2011; Newell, Adair and McGreal, 2010; Lizieri and Pain, 2013 and Lieser and Groh, 2013). The networks of third party support services (accountancy, legal and real estate services providers) that support cross-border real estate investment have also globalized in this period. Ball (2002) emphasized the importance of real estate investors and developers being able to rely on networks of professional firms that operate at a spatial scale equivalent to their own (see also D'Arcy, 2009). In the real estate services sector, the 'big four' (Jones Lang Lasalle, Cushman Wakefield, CBRE and DTZ) operate across all the major markets.

The focus of this paper is on the effects of increasing integration of real estate markets on real estate capitalization rates. Focusing at the city level, drawing upon DTZ's transaction database this research investigates the extent of variation in the level of foreign investment in the commercial offices markets of 28 European cities. Given that differences in levels of capitalization rates due to differences in liquidity, income growth expectations, market transparency, economic structure etc. are expected, we attempt to isolate the effect of foreign capital flows on capitalization rates. In the process, this research makes two contributions to the literature: first, a comprehensive study of the office market cap rate dynamics across 28 major EU markets; second, an explicit test of the foreign presence with a methodologically innovative two-stage modelling procedure. The rest of the paper is presented as follows: section 2 provides a discussion of theoretical underpinnings and a review of related research on this topic; section 3 describes the data; section 4 lays out the empirical strategy; the results are discussed section 5 followed by our concluding remarks in section 6.

2. THEORETICAL CONTEXT AND PREVIOUS RESEARCH

There are a number of theoretical and empirical grounds to expect foreign investment to have significant price effects. From an International Capital Asset Pricing Model perspective, the key determinant is the expectation that globally diversified investors have a lower risk premium. In this vein, Kang, Lee and Park (2010) argue that foreigners who invest in multiple countries and whose performances are likely to be assessed in a global context will evaluate domestic stocks via a global benchmark whilst domestic investors will use a local benchmark to evaluate domestic stocks. One consequence of the diversification benefits from cross-border investment is a change in the set of investors. In integrated markets, firms' share prices may benefit from increased capital flows from investors in previously segmented markets as integration allows the firms' risks to be shared by a much larger pool of investors with different risk exposures and risk appetites. It is expected that a global shareholder base results in a lower cost of capital and hence a greater equity value (see Stulz, 1999).

An increase in the size of the investor base produced by financial globalization is central to Merton's investor recognition hypothesis (Merton, 1987). Drawing upon both information and diversification rationales, a central behavioural assumption in Merton's model is that investors, in constructing their portfolios, only invest in securities with which they are familiar. For securities unfamiliar to foreign investors, the smaller pool of domestic investors may have to take

undiversified positions and, consequently, may require higher returns to compensate them for the higher specific risk associated. Hence the main proposition of this model is that the value of a security is increasing in the number of investors who know about the security.

Whilst the focus above is on investor heterogeneity, informational heterogeneity and asymmetries between local and foreign investors have been the topics of much research in the equity literature. There are contrasting hypotheses and evidence on whether local investors possess superior information and, therefore, superior valuation skills (see Kalev *et al*, 2008). On the one hand, it is argued that local investors are faced with fewer investment barriers compared foreign investors and, as a result, have easier access to firm-specific information (see for example, Hau, 2001; Dvorak, 2005; Brennan and Cao, 1997; Parwada et al., 2007). On the other hand, it has been argued that foreign investors tend to be more sophisticated investors with superior investment skills making better investment decisions (see Froot and Ramadorai, 2001; Grinblatt and Keloharju, 2000; Karolyi, 2002; Seasholes, 2004 among others). Chen *et al* (2009) identify a range of contrasting and inconsistent empirical findings on the performance of local and foreign investors. This inconsistency may suggest that the relative performance and pricing ability of local and foreign investors is contingent upon timescale of investment, locations of stock listing, maturity of the local market *inter alia*.

Although there are inconsistent findings on the relative performance of foreign and local investors, a stylized fact from the body of empirical work in equity markets is that foreign investors tend to have different patterns of investment compared to local investors and that the effect is to lower firms' cost of capital. Much of the research tends to be consistent with Merton's investor recognition hypothesis. The level of foreign ownership seems to be positively related to the market capitalization of firms and the amount of cash on their balance sheets, and negatively related to dividend yields. Covrig *et al.* (2007) find that foreign fund managers tend to invest only in those stocks that they know about with large market capitalization, large foreign sales, extensive analyst coverage, and whose stocks have foreign listings and index memberships. For instance, Kang and Stulz (1997) found that foreigners investing in Japan tend to be underweight in smaller and highly leveraged firms. Looking at pricing effects, Dahlquist and Robertsson (2004) found a strong link between the magnitude of a price impact and the fraction of foreign ownership of a firm; the higher the fraction, the larger is the price impact. Large, financially solid, and well-known firms show the largest reductions of cost of equity capital due to foreign investors.

Implicit in the conventional wisdom about foreign investment is that weight of money produces price pressure effects. However, as has been restated many times, under the efficient markets hypothesis, investor demand should not matter since prices are supposed to encapsulate the present value of the cash flow generated by the asset. Given this horizontal demand curve assumption, investors should be able to buy or sell any amount of a security without affecting its price. The common empirical observation of a downward sloping demand curve for securities is typically explained by deviations from a perfect market. In market segmentation literature, there is a longstanding body of work suggesting that the size and nature of the investor base does affect security prices. When perfect market assumptions are relaxed, there are strong *a priori* grounds to predict that the size of a security's investor base will affect its prices and returns.

In commercial real estate markets, it is almost axiomatic that deviations from perfect market assumptions are substantially larger. Thin trading, high search costs, information asymmetries, heterogeneous assets and expectations all increase the potential size and significance of clientele effects. Segmentation is also often highlighted between investor types. Short-hand clientele investor categories such as institution/non-institutional and core/value/opportunistic reflect variations in risk preferences amongst investor groups. Indeed, assets are also classified in the same way. There tends to be cross-sectional and time-varying variations in marginal investors for real estate assets with different investment qualities. There has been limited work on clientele effects in commercial real estate markets. Further developing work by Hardin and Wolverton (1999) and Lambson, McQueen and Slade (2004) and drawing upon a much larger sample of transactions, Ling and Petrova (2011) find evidence that tax-motivated, out-of-state and REITs buyers pay significantly more than in-state buyers. It is the effects on prices of the presence of a specific type of investor – foreign, international or non-domestic investors that is the focus of this research.

In the capital markets, there is a large body of empirical testing the Wall Street maxim that it takes trading volume to make prices move. Whilst a positive *contemporaneous* correlation between price changes and volume may be a stylized empirical fact, it is extremely debateable whether there is a causal relationship (see Gallant, Rossi and Tauchen, 1992). This contemporaneous positive relationship may be due to the fact that flows and returns are jointly dependent on common economic variables. As stated below, this is also key issue in analysing the relationship between capitalization rate and foreign investment.

In the real estate literature, the results of empirical work on the investment flow↔return relationship are mixed. Fisher, Ling and Naranjo (2007) examine whether net capital flows from institutional to non-institutional investors impact upon asset prices and returns in a cross-section of U.S. real estate sectors and geographic markets. At the aggregate U.S. level, they find evidence that institutional capital flows have a statistically and economically significant association with subsequent returns. However, the results are not consistent amongst sector or CBSAs. Applying a similar methodology to the UK data, Ling, Marcato and McAllister (2009) do not find any evidence to support a 'price pressure' effect. Both Stein (1995) and Cauley and Pavlov (2005) focus on the relationship between price changes and trading volume in US housing markets. They investigate the stylized fact that trading volumes tend to fall when house prices are falling and that rising prices tend to be associated with increases in transaction activity. Both papers suggest a contemporaneous and self-reinforcing relationship between prices and trading volume generated by exogenous demand shocks.

It is also notable that the body of academic work on the determinants of capitalization rates is largely silent on the effect of capital flows (see Sivitanidou and Sivitanides, 1999; Ambrose and Nourse, 1993; Chen, Hudson-Wilson and Nordby, 2004; Chervachidze, Costello and Wheaton, 2009). Two papers on capitalization rate determination include trading volume or fund flows as explanatory variables in their model specification with different results. Hendershott and MacGregor (2005) find that the share of real estate in institutional portfolios is negatively associated with capitalization rates. Clayton, Ling and Naranjo (2008) use capital flows as an input into a composite investor sentiment index. Using a VECM approach, they find no consistent role for sentiment in explaining the time series variation of capitalization rates during the period 1996-2007. Chervachidze and Wheaton (2013) focus on availability of debt (debt flow) as a driver of capitalization finding that changes in debt availability at the national level have significant effects on capitalization rates.

3. DATA

Transaction data on commercial real estate markets tends to be partial, particular (to the collector's circumstances and requirements), proprietary and/or private. To investigate cross-border real estate investment flows empirically, we have been provided with access to DTZ Research Investment Transactions Database (ITD). We use prime yields series as there is limited

reporting on actual transaction yields, especially on the continental Europe markets. DTZ is a real estate services firm offering a broad product range consisting of leasing agency and brokerage, integrated property and facilities management, capital markets, investment and asset management, valuation, building consultancy, project management and research and consulting services. It has 45,000 employees operating across 52 countries. The ITD is based on commercial property investment deals reported in the press (both property and general), company and fund reports, information supplied by external data providers and by DTZ local offices around the world. Transactions are collected by DTZ local offices. In addition the data is sourced from licensed property information providers. Transactions cover European deals in excess of €1 million and Asia Pacific deals in excess of US$5 million. The ITD database was first established as a means of collecting information on the UK investment transactions involving a foreign purchaser or vendor. It has subsequently developed to become an extensive source of information and now covers over 16 countries in Europe and nine countries in Asia Pacific. Historically, the UK has been collecting data more consistently with a greater richness of data and driven by investment, including overseas investment into the UK and especially in London which has been a major global financial centre. There are more data providers in the UK which helps with the quality of data.

Given the increasing globalization of investment markets allied with growing complexity of investment vehicles, in particular, the growth of unlisted, pooled funds, it is also important to acknowledge that it has become more and more challenging to classify ownership by nationality. DTZ defines a purchaser as foreign if the purchaser's source of capital or location does not stem from the same country where the property is located, the purchaser/vendor is categorised as foreign. When the purchaser is unknown it is assumed that the purchaser is domestic. DTZ's reasoning is that smaller deals are more likely to be transacted by domestic players. DTZ classifies the source of capital as intra-regional (investing in home region, but not home market e.g. UK investor in Germany, or German in Poland) and inter-regional (non-European investor, so Asian or US money for example in Europe). Our study is based on European markets. Therefore, we take both intra-regional and inter-regional classifications as foreign. However, as noted above, the notion of foreignness is increasingly becoming conceptually problematic in this context. The local offices of global service providers are typically the product of mergers with local practices employing local professionals who are embedded in local business and political networks. In essence, in most developed markets foreign real estate investing organisations who set up local operating platforms, by employing experienced local professionals in local offices

who are effectively enculturated insiders, are likely to have access to similar informational sets about local markets as local investors.

An increasing number of financial firms involved in real estate investment can be categorized as globalized. They have subsidiaries accessing capital in multiple countries so that a firm may have multiple headquarter locations. Many of the real estate investing institutions located in global financial centres will not be the ultimate investors in the sense that they are not the source of the capital. Capital may be drawn from a range of international markets and simply 'pass through' the major financial centres where there are hubs of intermediaries. Particularly when capital is pooled, there are major difficulties in establishing the ultimate source of the real estate investment routed through these centres. For instance, sovereign wealth funds such as the Abu Dhabi Investment Authority or Government of Singapore Investment Corporation (now GIC Private Limited) invest directly in real estate assets but also invest in pooled funds that may be located in one international market but invest in real estate assets in other markets. Given these issues, broad data on investment flows will not capture the nuances of specific transactions and investment entities. These definitional difficulties notwithstanding, the DTZ database provides a valuable source of data in cross-country real estate investment patterns that warrants a detailed analysis.

Whilst the data consists of sales from numerous small and large cities across Europe, the focus of the paper is on major office markets that are monitored by DTZ. The data set consists of 9126 office sales in 28 European cities in 15 countries between 2000 and 2013 with a total value of c€380 billion. The average transaction had an average value of c€40m. Definition of the control variables, data sources and summary statistics are described in Table 1. It is important to bear in mind a number of points about the data. Due to a range of interrelated attributes of real estate investment markets – thin trading, large lots, illiquidity etc., the term flow is a perhaps misleading analogy to describe patterns of real estate investment. Since foreign investors tend to buy larger lots, foreign capital market entry tends to be more sporadic, lumpy and uneven than investment by local investors. There is also a timing issue associated with reported transactions. Although the decision to commit fund funds may have taken place much earlier, flows tend to be recorded when legal completion of a transaction occurs.

[INSERT TABLE 1 HERE]

4. EMPIRICAL ESTIMATION STRATEGY

A testable hypothesis generated by the research objectives is: *All else equal, there is a negative relationship between the proportion of transactions involving foreign real estate investors and market capitalization rates.* We draw and build upon a well-established literature on modelling capitalization rates (see Sivitanides *et al*, 2002; Hendershott and MacGregor, 2005a, 2005b; Chichernea *et al*, 2008; Archer and Ling 1997; Chervachidze, Costello and Wheaton, 2009; Chervachidze and Wheaton, 2013 and Nanda and Tiwari, 2013). A simple empirical model includes the lagged dependent variable to help identify the robust effects.

$$\log(k_{ijt}) = \alpha_0 + \beta_1 \log(k_{ijt-1}) + \beta_2 RRFR_{jt} + \beta_3 \log(RRR)_{ijt} + \varepsilon_{ijt} \quad (1)$$

where k_{ijt} is the real estate capitalization rate in city *i* in country *j* at time *t*. $RRFR_{jt}$ is the real risk free rate (long-term rate) in country *j* at time *t*. $log(RRR)_{ijt}$ is the real rent ratio in city *i* in country *j* at time *t*. Real rent ratio is computed as a ratio of the real rent in a year and the sample period average of real rent. This variable acts as a portmanteau variable assumed to capture several attributes of the local office market dynamics. For example, the rent variation may increase during the expansionary phase of the business cycle as the real rent exceeds mean trend. Moreover, if investors form forward-looking expectations, a higher rent levels than the historical average (i.e. real rent ratio) will inform investors of the probable correction in the market which implies lower levels of future cash flows. However, it is also conceivable that a backward-looking mechanism of forming expectation may encourage investors to bid up asset values (Chervachidze and Wheaton, 2013). Therefore, the real rent ratio may capture the complex patterns in future rent expectations. ε_{ijt} is a time-variant unobservable, which is assumed to be randomly distributed and uncorrelated with the observed controls.

The literature has proposed inclusion of other macro-economic controls as well such as country risk premium (or, a risk factor), debt availability (or, a measure of domestic bank lending as a share of GDP) as in equation (2).

$$\log(k_{ijt}) = \alpha_0 + \beta_1 \log(k_{ijt-1}) + \beta_2 RRFR_{jt} + \beta_3 \log(RRR)_{ijt} + \beta_4 Risk_{jt} + \beta_5 Lending_{jt} + \varepsilon_{ijt} \quad (2)$$

Equation (2) is our baseline cap rate model, in line with the literature. While the parsimonious specifications in equations (1) and (2) are quite attractive, those are fraught with some severe econometric biases. First, although the real rent ratio by definition is able to capture much of the

local property market characteristics, city level data is notorious in terms of having a significant amount of unobserved heterogeneity. The unobserved heterogeneity may be modelled as fixed effects, after conducting the Heckman's specification test. However, we envisage that fixed effect modelling may be more appropriate than random effect modelling due to presence of small number of cross-sections. The advantage of this method is that it allows us to use both time series and cross sectional variations in the data, which increases the efficiency of the OLS estimates. A potential bias in estimating equation (2) is the possibility of correlation between unobserved heterogeneity at the local area level and the observables, which would violate standard assumptions of OLS estimation. Therefore, the disturbance term in equation (2) is specified as a two-way error component capturing area-specific (either city or country) fixed effects and time-specific effects.

$$\varepsilon_{ijt} = \mu_{ij} + \lambda_t + \upsilon_{ijt} \tag{3}$$

i.e.

$$\log(k_{ijt}) = \alpha_0 + \beta_1 \log(k_{ijt-1}) + \beta_2 RRFR_{jt} + \beta_3 \log(RRR)_{ijt} + \beta_4 Risk_{jt} + \beta_5 Lending_{jt} + \mu_{ij} + \lambda_t + \upsilon_{ijt} \tag{4}$$

where μ_{ij} denotes area-specific fixed effects and λ_t time-specific effects. We try both city and country fixed effects as cities and country may follow different trajectories. In this fixed effect specification, heterogeneity is assumed to be constant over time and correlated with observables. The constant effect is removed by mean-differencing (or first differencing) the data. This estimation strategy is consistent with the theoretical expectations that the market-specific unobserved characteristics can bring in a permanent shift in key real estate indicators such as rental growth, capital value growth, vacancy rate, net absorption and capitalization rate across markets. The fundamental demand and supply shifters can also reflect the unobserved heterogeneity. The two-way error component model would allow us to control for these unobservables.

Second, the fixed effect approach in equation (4) indicates another potential bias i.e. dynamic panel bias. Each cross-section or cities may follow its own error process. It is quite conceivable that a city would have panel-specific heteroscedasticity and auto-correlation process. This calls for incorporating the panel-specific variations into the parameter estimates. To address this issue, we follow a Feasible Generalised Least Squares (FGLS) procedure that allows for panel specific AR(1) process using the first-differenced data.

Third, a key variable in our study is proportion of foreign or non-domestic transactions (I_{ijt}), which can now be incorporated as follows:

$$\log(k_{ijt}) = \alpha_0 + \beta_1 \log(k_{ijt-1}) + \beta_2 RRFR_{jt} + \beta_3 \log(RRR)_{ijt} + \beta_4 Risk_{jt} + \beta_5 Lending_{jt} + \beta_6 I_{ijt} + \mu_{ij} + \lambda_t + \upsilon_{ijt} \quad (5)$$

An important concern with above estimation procedure is the potential simultaneity in relationships. The key issue is that an omitted variable(s) may be jointly determining capitalization rates (k_{ijt}) and foreign investment flows (I_{ijt}) in equation (5). A range of factors may affect both capitalization rate and foreign investment e.g. market transparency, growth prospects, liquidity etc. compounding the econometric problem of endogenous determination. Such joint dependency issues undermine the reliability of the empirical estimations. In order to counter the potential misspecification, we introduce a methodological innovation. Specifically, we attempt to purge the independent variables of the effects of interdependent determinants and estimate 'pure' effects. In the first stage, we estimate the determinants of cap rates using the Chervachidze and Wheaton (CW) model as in equation (4). The residual variation from this model then provides an estimate of the unexplained variance in capitalization rates that may be caused by other confounding factors e.g. market transparency, size, foreign investment, position in global urban economic hierarchy etc.

In the second stage, given that these additional variables also suffer from similar problems of joint dependency, we also purge these variables of common dependency by orthogonalization procedures. This orthogonalization process is guided by the correlation matrix in Table (3). Correlations between two variables greater than 25% are put through the orthogonalization process.

[INSERT TABLE 2 HERE]

We orthogonalize several correlated variables as follows:

$$Risk_{jt} = \alpha_0 + \beta_1 RRFR_{jt} + \beta_2 Lending_{jt} + \varphi_{jt}$$
$$\log(RRR)_{ijt} = \alpha_0 + \beta_1 RRFR_{jt} + \chi_{ijt}$$
$$\log(k_{ijt}) = \alpha_0 + \beta_1 \log(k_{ijt-1}) + \beta_2 RRFR_{jt} + \beta_3 \hat{\chi}_{ijt} + \beta_4 \hat{\varphi}_{jt} + \beta_5 Lending_{jt} + \mu_{ij} + \lambda_t + \upsilon_{ijt} \quad (6)$$

Specifically, $\hat{\chi}_{ijt}$ is the orthogonalized *log(RRR)*$_{ijt}$ against risk free rate, and $\hat{\varphi}_{jt}$ is the orthogonalized country risk factor against risk free rate and domestic lending share of GDP. Finally, we model the unexplained variance in cap rates in equation (6) i.e. $\hat{\upsilon}_{ijt}$ as a function of 'pure' real estate market transparency, world city indicator such as number of offices of Advanced Producer Services (APS) firms, indicators of a country's international linkages and financial market efficiency as measured by Aizenman *et al.* (2008) Trilemma indices and local space availability variables as follows. The Trilemma indices are important in capturing the macroeconomic management on three most important decision-making choices for policy makers i.e. monetary independence, exchange rate stability, and financial openness. This is called the 'trilemma' or the 'impossible trinity'. Past empirical evidences suggest that policy-makers attempt to achieve a combination of two out of the three goals under the Trilemma structure. We use exchange rate stability and monetary independence as our focus is on the European markets which have seen formation of European Union. However the correlation matrix in Table (3) calls for further orthogonalization procedure.

$$
\begin{aligned}
DTZ\_Liq_{jt} &= \alpha_0 + \beta_1 I_{ijt} + \beta_2 Trilemma1_{jt} + \beta_3 Trilemma2_{jt} + \theta_{jt} \\
GRETI_{jt} &= \alpha_0 + \beta_1 I_{ijt} + \beta_2 Trilemma1_{jt} + \beta_3 Trilemma2_{jt} + \theta_{jt} \\
Trilemma1_{jt} &= \alpha_0 + \beta_1 Trilemma2_{jt} + \omega_{jt} \\
\hat{\upsilon}_{ijt} &= \alpha_0 + \beta_1 I_{ijt} + \beta_2 \hat{\theta}_{jt} + \beta_3 \log(APS)_{ijt} + \beta_4 \hat{\omega}_{jt} + \beta_5 Trilemma2_{jt} + \mu_{ij} + \lambda_t + \psi_{ijt}
\end{aligned}
\tag{7}
$$

Specifically, $\hat{\theta}_{jt}$ is the GRETI score (or DTZ liquidity ratio in alternative specifications) orthogonalized against two trilemma indices, and $\hat{\omega}_{jt}$ is the trilemma1 being orthogonalized against trilemme2. Equation (7) can be extended to include further local real estate market controls such as the availability ratio.

$$
\hat{\upsilon}_{ijt} = \alpha_0 + \beta_1 I_{ijt} + \beta_2 \hat{\theta}_{jt} + \beta_3 \log(APS)_{ijt} + \beta_4 \hat{\omega}_{jt} + \beta_5 Trilemma2_{jt} + \beta_6 Avail_{ijt} + \mu_{ij} + \lambda_t + \psi_{ijt}
\tag{8}
$$

The two-stage procedure addresses multicollinearity issue and it should reveal the independent effect of the foreign presence in each city.

5. RESULTS AND ANALYSIS

Salient Data Features

Broadly the sample period is dominated by the period of stable real estate capitalization rates between 2000 and 2004. The mean capitalization rate falls dramatically between 2005 and 2007 in the market boom preceding the Global Financial Crisis (GFC) which began in the period 2007/8. During the GFC, average capitalization rates rose significantly peaking in 2009. However, cities within Europe have had very different trajectories in the sample period. Munich, Paris and London (West End) have had the lowest capitalization rates. Indeed, the DTZ cap rate series suggests that German cities have had low capitalization rates and remained relatively stable as signaled by low volatility in the sample period. In contrast, the four central and eastern European (CEE) cities have had high capitalization rates and high volatility. Outside of London, the other UK cities have similar profiles in terms of average capitalization rates and volatility. Of the core EU economies, reflecting the relatively high degree of macro-economic volatility of both national economies and the role of real estate in amplifying the economic cycle, the Republic of Ireland and Spain have experienced a much more extreme boom-bust cycle in the sample period.

Turning to capital flows, a notable feature of the data is the fact that London alone accounts for over half of all transactions by value. It has transaction volumes that are nearly five times greater than the next largest destination of real estate investment - Paris. It is difficult to assess the extent to which this is a data measurement issue or reflects accurately the relative attractions of London to real estate investors as a leading global city with a highly open and transparent real estate investment market[1]. Given that DTZ have their main offices in the UK and that there are a number of commercial providers of transaction information based in London (e.g. Real Capital Analytics, CoStar, EGi) it would be surprising if there were not some UK bias to the data. However, it is notable that there is little evidence of bias for the other UK cities.

[1] Findings from other studies are variable. Drawing upon a CWHB database, Lieser and Groh (2013) estimate commercial real estate transaction volumes of c$12.5 billion for France and c$45 billion for the UK in the period 2000-2009. Drawing upon the RCA database Lizieri and Pain (2013) estimate transaction volume of c$52 billion for Paris and c$88 billion for London office investment in the period 2007-2011. Also using RCA data, McAllister and Nanda (2014) find that the UK attracted approximately 15% of all cross-border real estate investment flows in the period 2007-2012 with France attracting 6%.

Whilst London was the largest centre for foreign real estate investment in absolute terms, it was not the largest in relative terms. At an aggregate level, transactions involving foreign purchasers account for approximately half of all transaction volume in the period 1999-2013. In line with high levels of foreign penetration in major economic sectors, cities in the transition economies of central and eastern Europe had the highest proportion of foreign relative to domestic investment.[2] For instance, foreign investors accounted for 94% of transaction volume in Warsaw. In the EU15 countries, foreign investors accounted for more than half of total investment in Amsterdam (63%), Brussels (62%) and Paris (60%). In London, the comparable figure was just under 50%. It is notable that the German cities which tended to have low capitalization rates also tended to have relatively low levels of foreign real estate investment. For instance, foreign investors in Munich which had the lowest mean capitalization rate in the sample period accounted for 24% of the transaction volume. Foreign investment is particularly low in Dublin which may have been perceived as overpriced by foreign investors during its boom period and too risky during the subsequent severe downturn.

[INSERT TABLE 3 HERE]

Standard Cap Rate Modelling

The diversity of market circumstances reinforces the importance of controlling for confounding variables in trying to isolate and estimate the effect of levels of foreign investment on real estate capitalization rates. Figure (1) shows variation in log(cap rate) across the markets. The results of the first stage regressions are presented in Table 4. Column (1) is the basic CW model as in equation (1). Model (2) estimates the FGLS model and subsequent models add further controls in models (3) and (4) as represented by equation (4). Equation (5) is estimated with city fixed effect instead of country fixed effects. It is quite conceivable that some cities may follow a different trajectory than the country e.g. London and UK or Paris and France. The results with city fixed effects are similar to the models (models 1-4) with country fixed effects. Model (6) excludes London to check robustness of results when we take out the London effect. The coefficient on lagged cap rates is approximately 0.4. This is largely similar to the results of the CW model finding for the US metro areas and is consistent with similar substantial momentum in the formation of capitalization rates. The real risk-free rate coefficient has the expected positive sign and is statistically significant. The real rent ratio has a statistically significant

[2] Nolke and Vliegenthart (2009) cite data on foreign ownerships for Polish, Czech and Hungarian economic sectors such as banking and manufacturing where foreign ownership levels of 80-90% are common.

negative sign. This indicates that capitalization rates are lower where real rents are above their long term average. This finding is also in line with the results of the CW models in the US. It is consistent with adaptive expectations by investors. When the basic model is extended to include additional variables, the coefficients remain stable. Perhaps unsurprisingly, there is a statistically significant positive coefficient for country risk on capitalization rates. All else equal, the level of bank lending in country has no significant effect on capitalization rates. When the model is extended to include the proportion of foreign investment in models (7) and (8) as in equation (5), we find a statistically significant negative effect. Other variables such as real estate market transparency, World City ranking (according to number of advanced producer services) and monetary and exchange rate variables are not significant. It is notable that the results remain broadly unchanged when London is excluded from the sample in model (8). However, given the endogeneity issues discussed above, we present an alternative two-stage econometric specification below.

[INSERT FIGURE 1 AND TABLE 4 HERE]

Second Stage Orthogonalized Models

With the residual variation from Model 5 in Table 4 as the dependent variable as reflected by equations (6) and (7), the finding of a negative effect of foreign investment remains robust. The results are reported in Table 5. Figure 2 panel A illustrates the distribution of residual variation across all markets averaged over time. It reveals that there are many markets such as Bucharest, Budapest, Warsaw, Dublin, Paris, Prague among others having a significant residual variation left unexplained by the basic CW cap rate model in equation (6), model (5) in Table (4). This leads us to the second stage modelling which attempts to further explain the residual variation. We do find that in all model specifications, the coefficient on the foreign investment variable is statistically significant and negative. This supports the hypothesis of an increase in foreign investment producing compression of capitalization rates. The results for the other confounding variables are broadly as expected. Moreover, a local market control of availability ratio is introduced in models (4) and (5). Where the number of advanced producer services is used as a basis for ranking cities as part of a global hierarchy, we find an expected negative effect of global city ranking on capitalization rate. The size of coefficient of APS variable is substantially larger (0.208) than other controls such as foreign investment, market transparency and space availability. It suggests that the city's position in global urban economic hierarchy that is the most important determinant of differences in office cap rates, albeit other determinants are also

statistically significant at 1% and 5% levels. Given the high level of monetary integration between the countries in the sample, we interpret the findings on monetary variables with some caution. However, we find a statistically significant negative coefficient for exchange rate stability and capitalization rate. This is consistent with higher exchange rate stability producing lower capitalization rates. In contrast, we find a statistically significant positive coefficient for the monetary independence variable. This may be due to the high level of monetary integration in the core EU countries noted above together with an association between lower monetary integration/higher monetary independence and economic performance.

[INSERT FIGURE 2 AND TABLE 5 HERE]

Figure 2 panel B presents the residuals left after the second stage modelling. It is interesting to find that while for most cities, the second stage model has been able to explain a large portion of the stage-1 unexplained variation, a few cities such as Copenhagen, Stockholm, Gothenburg still show a sizeable amount of residual variation, albeit in much smaller scale. It is notable that all these three cities are characterised by low cap rate and low foreign investment. Local idiosyncratic factors may be driving the variation. The notable difference between panel A and panel B residual map reinforces the importance of controlling for the confounding factors such as foreign investment, market transparency and position in global urban economic hierarchy. Overall, the results from table (4) indicate a statistically significant negative impact of foreign investment on local cap rate. When we address the econometric biases such as unobserved heterogeneity, simultaneous determination and dynamic panel bias, the results remain significant at 1% and 5% levels.

Robustness Tests

We test several alternative models and samples to address some robustness concerns. Table 6 reports the four robustness tests that we have performed. Specifically, in model (1), we specifically test whether an explicit control for Global Financial Crisis would alter the broad results significantly. The negative effect of the foreign investment remains robust to inclusion of the GFC dummy. In model (2), we use the DTZ Liquidity Ratio as an alternative control for real estate transparency. Again, there are no significant differences in the results. In our sample of cities, London is the most dominant city attracting a high volume of foreign investment. When London is excluded from the sample in model (3), the results remain quite robust. Moreover, in

Bucharest and Warsaw, almost 99% and 95% of the transactions are completed by international investors respectively. In model (4), we exclude both the cities and the results remain robust.

[INSERT TABLE 6 HERE]

All robustness tests indicate a very robust and statistically significant effect of the share of foreign investment on local cap rate. Essentially, these results confirm that the specifications and the significant coefficient estimates for foreign investment in Models 7 and 8 in Table 4 do not suffer from substantial endogeneity bias. When we address econometric biases such as unobserved heterogeneity, simultaneous determination and dynamic panel bias in Tables 5 and 6, the results remain statistically significant and remarkably robust. Therefore, it is reasonable to interpret the results from Models 7 and 8 in Table 4 as relatively unbiased i.e. a 100 basis points (or 1 percentage point) increase in foreign share of total investment in a European metropolitan office market causes about a three basis points decrease in the market cap rate. In other words, it predicts a 30 basis points fall in cap rate following a 10 percentage point increase in foreign share of total investment.

6. CONCLUDING REMARKS

Whilst market participants often presume a positive effect on real estate prices due to the presence of foreign buyers, there has been no empirical investigation. The ICAPM predicts a positive effect on prices as diversification reduces risk premia. The empirical evidence on the impact of foreign investors in the equity markets has been relatively sparse in this respect. Broadly, it suggests that foreign investors tend to focus on large, 'recognised' stocks and that there is a positive effect of foreign investment on prices and, consequently, a negative effect of cost of capital. In this study, we provide the first attempt to estimate the effects of cross-border real estate investment flows on commercial real estate market prices.

There are substantial methodological challenges in isolating the effect of foreign investment on capitalization rates. The key issue is that both foreign investment levels and capitalization rates are likely to be jointly determined by interdependent variables such as real estate market maturity and transparency, economic vitality and market risk. In this paper, we counteract these problems by modelling the determinants of the variance in capitalization rates that is not explained by 'standard' variables such as risk free rates and rental growth expectations. Using

orthogonalization procedures to identify and isolate the 'pure' effects of potential determinants of variance in capitalization rates unexplained by the standard variables, we find that there is a statistically significant negative effect of foreign investment on capitalization rates. Put simply, when controls are introduced to confound for the expectation that cities with low capitalization rates and *high levels of foreign investment* are likely to be in the mature real estate markets of economically dynamic global cities, the finding of a negative effect of foreign investment on capitalization rates remains robust.

The most important implication of these results is on the pricing mechanism and forecasting of the property market performance in local office markets. Anecdotal evidence suggests that foreign investors tend to invest in premium real estate locations and assets. City size, economic importance and real estate market liquidity and transparency are affecting capitalization rates and the level of foreign investment. Therefore, although, the transmission of demand from foreign investors to real estate prices is likely to be complex, the net effect on the cap rate is significant and it suggests that foreign presence should be factored into analysing local market dynamics as 'anchoring' domestic transactions to the price dynamics of foreign transactions may have a 'ratchet' effect. Our analsysis has also raised few further questions. Are price effects being felt only in specific markets and is segmentation in the office investment market increasing? To what extent are such clientele effects likely to be temporary or persistent?

REFERENCES

Aizenman, J, Chinn, M.D., and Ito, H. (2008). Assessing the Emerging Global Financial Architecture: Measuring the Trilemma's Configurations over Time, NBER Working Paper Series, #14533.

Ambrose, B. and Nourse, H. (1993). Factors influencing capitalisation rates. *Journal of Real Estate Research*, 8(2), 221-237.

Archer, W. A. and Ling, D.C. (1997). The three determinants of real estate market linking space, capital and property markets. *Real Estate Finance*, Fall, 7-14.

Ball, M. (2002) The Organisation of Property Development Professionals and Practices, in Guy, S. and Henneberry, J. (eds) *Development and Developers: Perspectives on Property*, Oxford, Blackwell Publishing.

Bond, S.A., Karolyi, G.A., and Sanders, A.B. (2003) International real estate returns: a multifactor, multicountry approach. *Real Estate Economics*, 31: 481-500.

Brennan, M. J., and Cao, H. H. (1997). International portfolio investment flows. *The Journal of Finance*, 52(5), 1851-1880.

Chen, J., Hudson-Wilson, S. and Nordby, N. (2004) Real estate pricing spreads and sensibilities: why real estate pricing is rational, *Journal of Real Estate Portfolio Management*, 10, 1–22.

Chervachidze, S., Costello, J. and Wheaton, W. (2009). The secular and cyclic determinants of capitalisation rates: the role of property fundamentals, macroeconomic factors and structural changes. *The Journal of Portfolio Management*, 35(5), 50-69.

Chervachidze, S. and Wheaton, W. (2013). What Determined the Great Cap Rate Compression of 2000–2007, and the Dramatic Reversal During the 2008–2009 Financial Crisis? *The Journal of Real Estate Finance and Economics* 46(2): 208-231.

Chichernea, D., Miller, N., Fisher, J., Sklarz, M. and White, R. (2008). A cross-sectional analysis of cap rates by MSA. *Journal of Real Estate Research*, 30(3), 10-29.

Chen, L.W., Johnson, S.A., Lin, J.C., and Liu, Y.J. (2009). Information, sophistication, and foreign versus domestic investors' performance. *Journal of Banking and Finance*, 33(9), 1636-1651.

Coval, J.D. and Moskowitz, T. J. (2001) The geography of investment: Informed trading and asset prices, *Journal of Political Economy*, 109: 811-841.

Dahlquist, M., and Robertsson, G. (2004). A note on foreigners' trading and price effects across firms. *Journal of Banking and Finance*, *28*(3), 615-632.

D'Arcy, E. (2009) The evolution of institutional arrangements to support the internationalisation of real estate involvements: Some evidence from Europe, *Journal of European Real Estate Research*, 2: 280 – 293.

Dvořák, T. (2005). Do domestic investors have an information advantage? Evidence from Indonesia. *The Journal of Finance*, 60(2), 817-839.

Eichholtz, P.M., Gugler, N. and Kok, N. (2011) Transparency, integration, and the cost of international real estate investments. *The Journal of Real Estate Finance and Economics*, 43(1), 152-173.

Falkenback, H. (2009) Market Selection for International Real Estate Investments, *International Journal of Strategic Property Management,* 13: 299–308.

Froot, K.A., and Ramadorai, T. (2001). The information content of international portfolio flows (No. w8472). National Bureau of Economic Research.

Gallant, A.R., Rossi, P.E., and Tauchen, G. (1992). Stock prices and volume. *Review of Financial studies*, 5(2), 199-242.

Grinblatt, M., and Keloharju, M. (2000). The investment 20rthogona and performance of various investor types: a study of Finland's unique data set. *Journal of Financial Economics*, 55(1), 43-67.

Hardin III, W.G., and Wolverton, M.L. (1999). Equity REIT Property Acquisitions: Do Apartment REITs Pay a Premium? *Journal of Real Estate Research*, 17:1/2, 113-126.

Hau, H. (2001) Location Matters: An Examination of Trading Profits. *Journal of Finance* 56(5): 1959–1983.

Hendershott, P.H. and MacGregor, B.D. (2005a), Investor rationality: evidence from UK property capitalisation rates. *Real Estate Economics*, 26, 299-322.

Hendershott, P.H. and MacGregor, B.D. (2005b), Investor rationality: An analysis of NCREIF commercial property data, *Journal of Real Estate Research*, 26, 10-29.

Kalev, P.S., Nguyen, A.H., and Oh, N.Y. (2008). Foreign versus local investors: Who knows more? Who makes more? *Journal of Banking and Finance*, *32*(11), 2376-2389.

Kang, H.C., Lee, D.W., and Park, K.S. (2010). Does the difference in valuation between domestic and foreign investors help explain their distinct holdings of domestic stocks? *Journal of Banking and Finance*, 34(12), 2886-2896.

Kang, J. and Stulz, R. (1997). Why is there a home bias? An analysis of foreign portfolio equity ownership in Japan. *Journal of Financial Economics*, 46, 3–28.

Karolyi, G.A. (2002). Did the Asian financial crisis scare foreign investors out of Japan?. *Pacific-Basin Finance Journal*, 10(4), 411-442.

Lambson, V.E., McQueen, G.R., Slade, B.A. (2004) Do Out-of-State Buyers Pay More for Real Estate? An Examination of Anchoring-Induced Bias and Search Costs, *Real Estate Economics,* 32(1): 85–126.

Ling, D.C., and Naranjo, A. (2002). Commercial real estate return performance: a cross-country analysis. *The Journal of Real Estate Finance and Economics*, 24(1-2), 119-142.

Ling, D.C. and Petrova, M. (2011). Why Do REITs Go Private? Differences in Target Characteristics, Acquirer Motivations, and Wealth Effects in Public and Private Acquisitions, *Journal of Real Estate Finance and Economics*, 43(1-2), 99-129.

Lizieri, C. (2009) *Towers of Capital: Office Markets and International Financial Services* Oxford: Wiley-Blackwell.

Lizieri, C., Reinert, J. and Baum, A. (2011). *Who Owns the City? Change and Global Ownership of City of London Offices.* Report for Development Securities PLC.

Lizieri, C. and Pain, K. (2014) International Office Investment in Global Cities: The Production of Financial Space and Systemic Risk, *Regional Studies*, 48(3), 1-17.

McAllister, P. and Nanda, A. (2014) Which Factors Determine Cross-Border Real Estate Capital Flows? A Gravity Modelling Approach, SSRN working paper. Available at: http://dx.doi.org/10.2139/ssrn.2417559

Merton, R. (1987) A simple model of capital market equilibrium with incomplete information. *Journal of Finance*, 42, 483–510.

Nanda, A. and Tiwari, P. (2013). Sectoral and Spatial Spillover Effects of Infrastructure Investment: A Case Study of Bengaluru, India. The Royal Institution of Chartered Surveyors (RICS) Research Report. http://www.rics.org/uk/knowledge/research/research-reports/infrastructure-investment-in-bengaluru-india/

Newell, G., Adair, A. and McGreal, S. (2010). Robustness of capital flows into the European commercial property markets during the global financial crisis. *Journal of European Real Estate Research*, 3(3), 182-202.

Nölke, A., and Vliegenthart, A. (2009) Enlarging the varieties of capitalism: The emergence of dependent market economies in East Central Europe. *World Politics*, 61: 670-702.

Parwada, J., Walter, T., and Winchester, D. (2007). Foreign investors' trading disadvantages in US stock market: An analysis by country of origin. *Unpublished Working Paper, University of New South Wales.*

Seasholes, M.S. 2004. Re-examining Information Asymmetries in Emerging Stock Markets. Unpublished Working Paper, University of California, Berkeley, CA.

Shiller, R. 1998. Comment on Vincent Warther, Has the rise of mutual funds increased market instability? Brooking-Wharton Papers.

Sirmans, C.F. and Worzala, E. (2003) International direct real estate investment: a review of the literature, *Urban Studies*, 40: 1081-1114.

Sivitanides, P., Southard, J., Torto, R. and Wheaton, W. (2001). The determinants of appraisal based capitalisation rates. *Real Estate Finance*, 18(2), 27-37.

Sivitanidou, R. and Sivitanides, P. (1999). Office capitalisation rates: Real estate and capital market influences. *The Journal of Real Estate Finance and Economics*, 18(3), 297-322.

Stulz, R.M. (1999). Globalization, corporate finance, and the cost of capital. *Journal of Applied Corporate Finance*, 12(3), 8-25.

Worzala, E. and Sirmans, C.F. (2003) Investing in international real estate stocks: a review of the literature, *Urban Studies*, 40: 1115-1149.

Zheng, L. 1998. *Who moves the market?* Working Paper, University of Michigan Business School.

Table 1: Variable Description and Summary Statistics (28 cities in 15 European countries 1999-2013)

Variable	Description	Source	Obs	Mean	SD
Cap rate	Prime office market cap rate	DTZ database	416	6.12	1.29
Real risk free rate	Long term interest rate; yields of government bonds with maturities of close to ten years	European Central Bank	413	1.83	1.82
Real rent ratio	Ratio of real rent index from DTZ rent database for a given city in a given year to the historical average of real rent for the city.	DTZ database; inflation from European Central Bank	420	1.00	0.16
Availability ratio	Office space availability/total office stock	DTZ database	390	8.58	4.93
Country risk factor	Spread between 10-year EU Government benchmark bond yield and country-specific nominal risk free rate	European Central Bank	413	-0.09	1.27
Bank lending %GDP	Domestic credit provided by financial sector (% of GDP)	World Bank	392	130.97	50.36
CPI Inflation	Consumer Price Index	European Central Bank	420	2.66	3.92
Foreign%	% of transactions by foreign buyers	DTZ ITD database	420	37.80	34.92
DTZ Liquidity Ratio	Market liquidity measure	DTZ database	420	5.19	3.55
GRETI	JLL Global Real Estate Transparency Index	JLL	420	1.74	0.51
Number of APS firms	Number of offices of Advanced Producer Service (APS) firms	GaWC	420	117.82	74.71
Trilemma Index – Exchange rate stability	Annual standard deviations of the monthly exchange rate between the home country and the base country are calculated.	Aizenman, Chinn, and Ito (2008) http://web.pdx.edu/~ito/trilemma_indexes.htm	392	0.59	0.34
Trilemma Index – Monetary independence	Monetary independence measured as the reciprocal of the annual correlation between the monthly interest rates of the home country and the base country. Money market rates are used for the calculation.	Aizenman, Chinn, and Ito (2008) http://web.pdx.edu/~ito/trilemma_indexes.htm	392	0.19	0.21

Table 2: Correlation Matrix

	Cap rate	Real risk free rate	Real rent ratio	Availability Ratio	Country risk factor	Lending %GDP	Foreign%	GRETI	Number of APS firms	Trilemma-Exchange rate stability	Trilemma-Monetary independence
Cap rate	1.00										
Real risk free rate	-0.04	1.00									
Real rent ratio	-0.25	**-0.33**	1.00								
Availability Ratio	0.25	-0.09	-0.05	1.00							
Country risk factor	-0.48	**-0.25**	0.15	-0.23	1.00						
Bank lending %GDP	-0.42	-0.04	0.15	0.00	**0.36**	1.00					
Foreign%	0.22	-0.05	-0.01	0.07	**-0.25**	**-0.32**	1.00				
GRETI	0.51	-0.12	-0.05	0.15	**-0.59**	**-0.65**	**0.35**	1.00			
Number of APS firms	-0.27	0.04	0.01	-0.06	0.06	0.07	0.16	0.01	1.00		
Trilemma – Exchange rate stability	-0.07	0.05	0.02	-0.14	0.04	0.13	-0.04	0.05	0.21	1.00	
Trilemma – Monetary independence	0.26	-0.16	-0.13	0.18	**-0.25**	-0.37	0.24	0.24	-0.19	**-0.66**	1.00

Note: Variables with more than 25% correlation are specified in regression after the orthogonalization process.

Table 3: Office Market Transactions across 28 cities in 15 European countries: Summary Data

	Cap Rate (%)		Transaction volume (€m p.a.)		% Foreign	
City	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Amsterdam	6.35	0.47	647	54	63%	23%
Antwerp	7.28	0.31	61	180	30%	43%
Barcelona	5.60	0.59	344	195	40%	24%
Berlin	5.24	0.29	369	198	29%	34%
Birmingham	6.18	0.61	120	221	42%	25%
Brussels	6.28	0.38	734	404	62%	22%
Bucharest	8.66	1.85	58	96	99%	2%
Budapest	7.91	1.15	155	177	79%	38%
Copenhagen	5.55	0.64	174	249	16%	23%
Dublin	5.58	1.13	236	333	7%	12%
Dusseldorf	5.33	0.29	252	308	28%	26%
Frankfurt	5.30	0.31	739	596	31%	30%
Glasgow	6.16	0.56	236	147	39%	26%
Gothenburg	5.83	0.64	74	53	33%	38%
Hamburg	5.52	0.40	293	288	19%	20%
Helsinki	6.07	0.70	57	69	48%	41%
Leeds	6.29	0.60	164	114	26%	24%
London	**4.95**	**0.57**	**13487**	**6559**	**50%**	**14%**
Madrid	5.49	0.57	945	660	35%	30%
Manchester	6.20	0.67	299	173	26%	19%
Marseilles	7.39	1.18	72	67	34%	43%
Milan	5.81	0.40	591	424	34%	29%
Munich	4.85	0.27	389	396	24%	26%
Paris	5.12	0.71	2774	1186	60%	18%
Prague	7.46	1.65	314	346	82%	28%
Sheffield	7.07	0.83	43	34	12%	25%
Stockholm	5.35	0.72	667	528	26%	23%
Warsaw	7.73	2.08	422	339	94%	7%

Source: DTZ ITD database.

Table 4: Panel Data Models Explaining Office Cap Rate Dynamics across 28 European Cities (1999-2013)

	(1) Log(cap rate)	(2) Log(cap	(3) Log(cap	(4) Log(cap	(5) Log(cap	(6) Log(cap rate)	(7) Log(cap	(8) Log(cap rate)
Log(cap rate)_lag1	0.869***	0.429***	0.397***	0.397***	0.366***	0.381***	0.340***	0.365***
	(33.58)	(10.34)	(8.92)	(8.87)	(8.27)	(8.23)	(7.11)	(7.34)
Real risk free rate	0.007**	0.006***	0.008***	0.009***	0.009***	0.009***	0.009***	0.009***
	(3.18)	(3.88)	(4.79)	(4.78)	(5.30)	(4.85)	(4.73)	(4.30)
Log(Real rent ratio)	0.021	-0.164***	-0.244***	-0.246***	-0.299***	-0.265***	-0.320***	-0.276***
(orthogonalised)	(0.80)	(-4.52)	(-5.48)	(-5.48)	(-6.90)	(-5.74)	(-6.89)	(-5.52)
Country risk factor			0.006*	0.007*	0.007**	0.007*	0.011	0.002
(orthogonalised)			(1.71)	(1.87)	(2.04)	(1.85)	(0.17)	(0.29)
Bank lending%GDP				0.0004	0.0003	0.0002	0.0001	0.0001
				(1.35)	(1.11)	(0.75)	(0.43)	(0.15)
Foreign%$_{t-1}$							***-0.0003****	***-0.0003****
							(-2.26)	***(-2.31)***
GRETI – Transparency							0.031	0.029
(orthogonalised)							(1.54)	(1.47)
Log(number of APS firms)							0.031	0.027
							(0.74)	(0.65)
Trilemma Index- Exchange rate							-0.031	-0.025
(orthogonalised)							(-0.52)	(-0.41)
Trilemma Index- Monetary							0.014	0.004
							(0.21)	(0.06)
Constant	0.224***	1.937***	1.926***	1.927***	1.984***	1.984***	1.869***	1.882***
	(4.50)	(88.73)	(88.88)	(89.74)	(128.52)	(131.13)	(12.41)	(12.31)
Model Specifications	OLS, Country/Year Fixed Effects (FE)	FGLS differenced Panel-AR(1) Country FE	FGLS differenced Panel-AR(1) Country FE	FGLS differenced Panel-AR(1) Country FE	FGLS differenced Panel-AR(1) City FE	FGLS differenced Panel-AR(1) City FE	FGLS differenced Panel-AR(1) City FE	FGLS differenced Panel-AR(1) City FE
Sample (annual)	28 cities 1999-2013	28 cities 1999-2013	28 cities 1999-2013	28 cities 1999-2013	28 cities 1999-2013	27 cities 1999-2013 (w/o London)	28 cities 1999-2013	27 cities1999-2013 (w/o London)
Goodness of fit: R^2	0.924							
p-value>Wald χ2		0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	384	380	353	353	353	340	325	313

Note: Robust standard errors are computed and t-statistics are reported within parentheses. ***p<0.01; **p<0.05; *p<0.1. A correlation check has been carried out and variables with more than 25% correlation have been orthogonalised such as log(real rent ratio) and country risk factor. Models (1) to (5) are comparable to the specifications from Chervachidze and Wheaton (2013) study with US metro-level information. The sample size across the models is affected by unavailable country and city-level data on cap rate, risk free rate and rent ratio in early years for Budapest, Bucharest, Prague and Warsaw and also lack of bank lending information in 2013 for all 15 countries (28 cities).

Table 5: Endogenous Determination of the Effect of Foreign Investment on Office Cap Rate across 28 European Cities (1999-2013)

	(1) Log(cap rate)	(2) Residual model (1)	(3) Residual model (1)
(Log)Cap rate$_{t-1}$	0.366***	0.241***	
	(8.27)	(5.04)	
Real risk free rate	0.009***		
	(5.30)		
Log(Real rent ratio)	-0.299***		
(orthogonalised)	(-6.90)		
Country risk factor	0.007**		
(orthogonalised)	(2.04)		
Bank lending%GDP	0.0003		
	(1.11)		
Foreign%_lag1		***-0.000003******	***-0.000002*****
		(-4.20)	***(-3.62)***
GRETI – Transparency		-0.0003***	-0.0003***
(orthogonalised)		(-3.24)	(-3.08)
Log(number of APS firms)		-0.012***	-0.015***
		(-15.51)	(-75.37)
Trilemma Index- Exchange rate stability		-0.001***	-0.002***
(orthogonalised)		(-3.86)	(-5.12)
Trilemma Index- Monetary independence		0.0008*	0.001***
		(1.95)	(3.04)
Constant	1.984***	0.061***	0.081***
	(128.52)	(15.74)	(110.14)
Model Specifications	FGLS Differenced Panel AR(1) City FE	FGLS Differenced Panel AR(1) City FE	FGLS Differenced Panel AR(1) City FE
Sample (annual)	28 cities (1999-2013)	28 cities (1999-2012)	28 cities (1999-2012)
Goodness of fit: *p-value>Wald χ2*	0.000	0.000	0.000
N	353	296	325

Note: Robust standard errors are computed and t-statistics are reported within parentheses. ***p<0.01; **p<0.05; *p<0.1. A correlation check has been carried out and variables with more than 25% correlation have been orthogonalised such as log(real rent ratio), country risk factor, GRETI and Trilemma index of exchange rate stability. Model (1) is same as in model (5) in Table (4). Model (1) specification is used to compute first stage residuals, which are then used as the dependent variable in models (2) to (5).

Table 6: Robustness checks: Effect of Foreign Investment on Office Cap Rate across 28 European Cities (1999-2013)

	(1) Residual model (1)	(2) Residual model (1)	(3) Residual model (1)	(4) Residual model (1)
Foreign%_lag1	***-0.000002******	***-0.0000014****	***-0.0000027******	***-0.0000028******
	(-3.74)	***(-1.93)***	***(-3.77)***	***(-4.15)***
GRETI – Transparency	-0.0001		-0.0003***	-0.0003***
(orthogonalised)	(-1.05)		(-3.23)	(-3.93)
DTZ Liquidity Ratio		-0.00002***		
(orthogonalised)		(-2.88)		
Log(number of APS firms)	-0.016***	-0.0159***	-0.0156***	-0.0156***
	(-84.12)	(-69.68)	(-75.81)	(-75.11)
Trilemma Index- Exchange rate stability	-0.001***	-0.0015***	-0.0020***	-0.0021***
(orthogonalised)	(-3.82)	(-3.25)	(-5.01)	(-5.11)
Trilemma Index- Monetary independence	0.001***	0.0012**	0.0014***	0.0014***
	(2.77)	(2.40)	(3.03)	(3.11)
GFC dummy	0.0003***			
	(6.49)			
Constant	0.081***	0.081***	0.081***	0.081***
	(121.37)	(110.59)	(109.34)	(109.99)
Model Specifications	FGLS Differenced Panel AR(1) City FE	FGLS Differenced Panel AR(1) City FE	FGLS Differenced Panel AR(1) City FE	FGLS Differenced Panel AR(1) City FE
Sample (annual)	28 cities (1999-2012)	28 cities (1999-2012)	27 cities excluding London (1999-2012)	25 cities excluding London, Bucharest and Warsaw (1999-2012)
Goodness of fit: *p-value>Wald χ2*	0.000	0.000	0.000	0.000
N	325	325	313	294

Note: Robust standard errors are computed and t-statistics are reported within parentheses. ***p<0.01; **p<0.05; *p<0.1. We take model (4) in Table 5 and test the above robustness concerns.

Figure 1: Distribution of log(office cap rate)

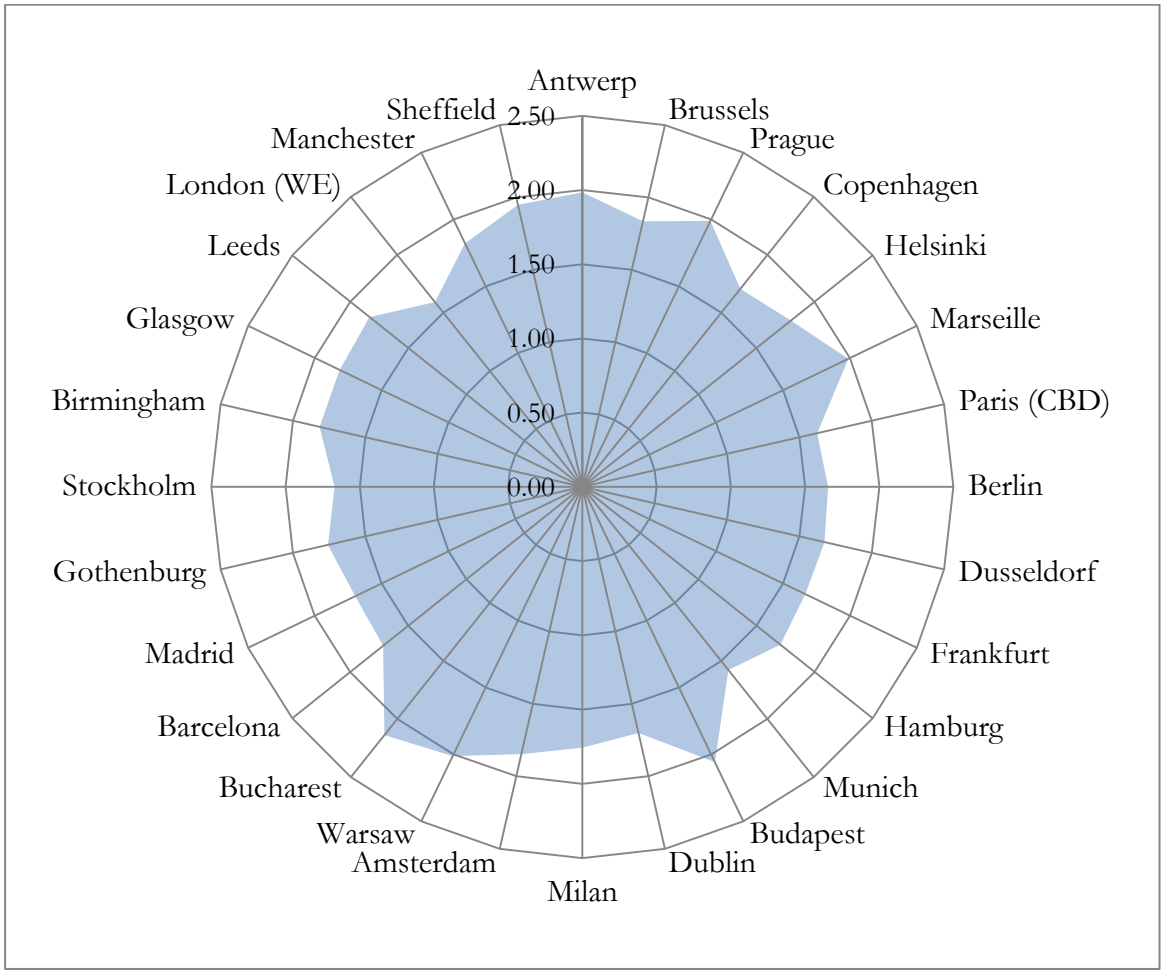
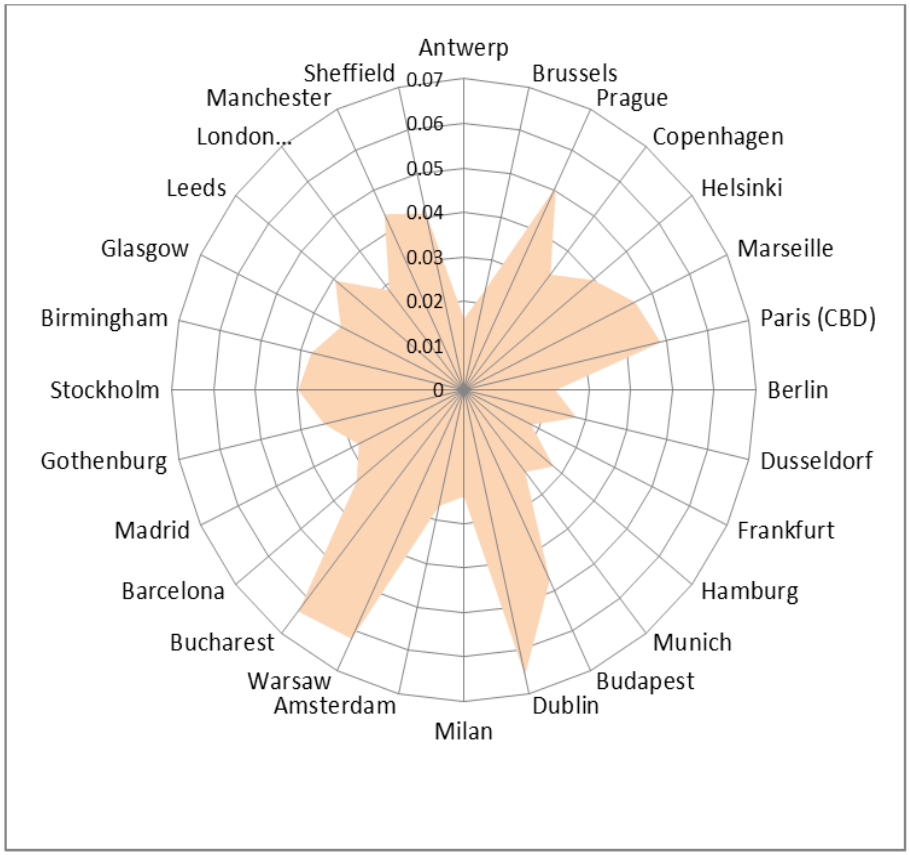
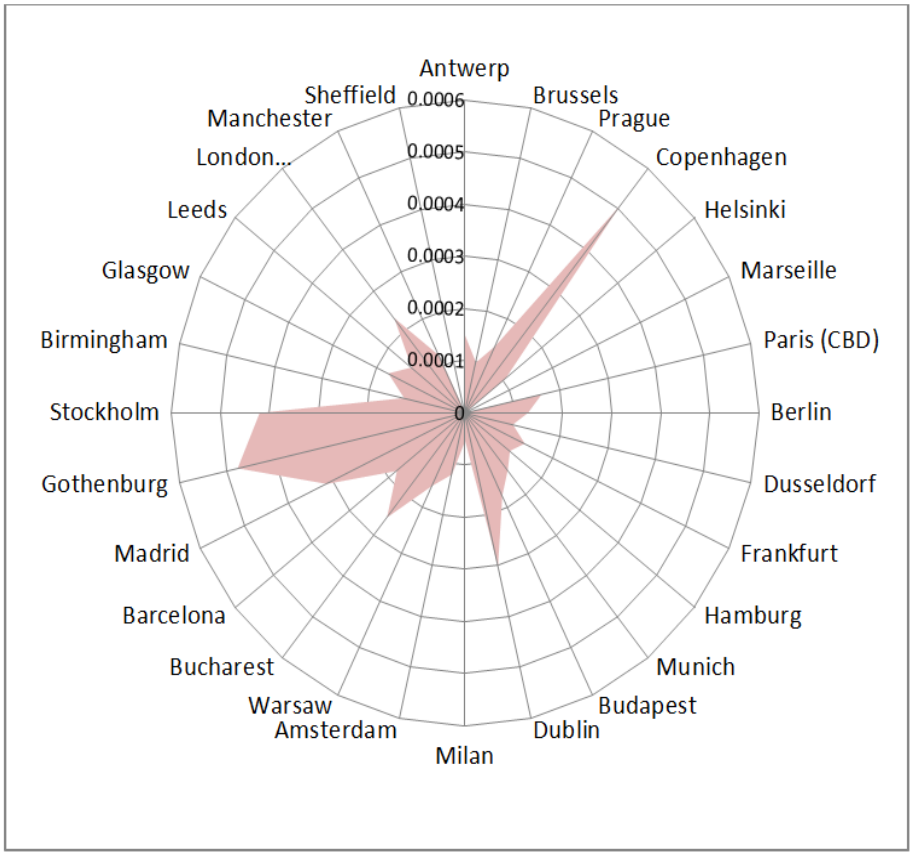


Figure 2: Distribution of Stage-1 and Stage-2 cap rate residuals

Panel A: Stage-1 residuals



Panel B: Stage-2 residuals



Note: Stage-1 residuals are computed from Equation (6) i.e. Model (5) in Table (4) and Model (1) in Table (5). Stage-2 residuals are computed from Equation (8) i.e. Model (4) in Table (5).