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Real estate investment and urban density: Exploring the polycentric urban region using a topological lens.

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ABSTRACT

Focusing on commercial office real estate as both a manifestation of and a conduit of cross border capital flows, this paper refers to the concepts of topology and topography in a theoretical and empirical exploration of contemporary 'network economy' spatial implications for the 'polycentric urban region' (PUR). A body of research has cast doubt on the normative European representation of the multi-centre PUR as a balanced, sustainable spatial development model. Yet the model has continued to be propagated in European territorial strategy and has been influential internationally. Academic perspectives and qualitative evidence reviewed in the paper shed light on mutual dependencies and recursive relations between network economy global structural processes, international office real estate investment practices mediated by city governments, and the spatial

configuration of density. Commercial investment and city planning actor practices chime with urban agglomeration, spatial concentration and density. Quantitative evidence of associations between urban density and office real estate investment returns and capital flows is found. It is concluded that network economy topology, politics and the city, are in a dialectical relationship with the PUR territorial governance agenda for spatially balanced regional development.

KEY WORDS

'Polycentric urban region', 'Topology', 'Topography', 'Real estate', 'Urban density', 'Territorial governance', 'Spatial planning'. 'Actor practices'

INTRODUCTION

This article contributes to the seemingly unceasing debate in urban and regional studies on polycentrism, scale and the region as the spatial logic of the post-industrial economy continues to unfold (Cox, 2013; Jessop, 2016). Since Gottman (1961) famously branded the extensive urbanized Northeastern Seaboard of the United States 'megalopolis', the apparent rise of inter-linked 'multifunctional, multinuclear spatial structures' (Castells, 1989), or the 'multi-core metropolis' (Hall, 1999), has been a recurrent research theme (Carbonell and Yaro, 2005; Lang and Dhavale, 2005; Harrison et al., 2015; Pain, 2016). Scott's (2001) conceptualization of the 'global city region' marked a timely turn of theoretical attention to the global integration of multi-centre regions (EC, 1999) in the 'network economy' paradigm (Castells, 1996). Reflecting the mediation of contemporary spatial relations by global economic agents and cross-border capital flows, our article refers to the "post-mathematical" concept of topology (Secor, 2013; Martin and Secor, 2014, 240) in an exploratory investigation of the implications of network economy processes, agential practices and the spatial configuration of urban density for the 'polycentric urban region' (PUR) (Amin and Thrift, 1992, 1993; Pryke and Lee, 1995; McFarlane, 2015; Hoffman and Thatcher, 2019).

For McFarlane, the historically politicized concept of urban density must inform the emerging topological research area and "is back at the heart of the global urban agenda" (2015, 629).

A body of new millennium research has called into question the validity of the internationally influential European 'Spatial Development Perspective' (ESDP), which depicted the PUR as a sustainable model for addressing "imbalanced spatial development" to counter concentration "in a few metropolises" (EC, 1999, p. 20; Kloosterman and Lambregts, 2001; Davoudi, 2003; Halbert et al., 2008; Meijers, 2008; Burger et al., 2014). European Commission (1999, p. 20) claimed that "the concept of polycentric development has to be pursued, to ensure regionally balanced development, because the EU is becoming fully integrated in the global economy". However, research on the multiscalar network and flow geographies of polycentric regions in North Western Europe, revealed their spatially uneven pattern of urban functional connectivity to global financial and linked business services (Hall and Pain, 2006). Pain and Hall (2008, pp. 1067-68) observed that, "as well as different kinds of polycentricity (morphological versus functional), there are also different scales of polycentricity: polycentricity at one scale might mean monocentricity at another". However, as Burger and Meijers (2012, 1127) noted, the relationship between 'morphological' and 'functional' polycentricity has remained poorly understood "and relatively little effort has been made to connect these two trains of thought". The issue whether 'form follows function' or function follows form at a regional scale, remains perplexing (Burger and Meijers, 2012). Yet the PUR has continued to be referred to in regional spatial strategy as a singular, evenly distributed, urbanized formation that is a more sustainable path for development than the one-agglomeration 'monocentric' urban region (Spaans and Stead, 2016; Boussauw et al., 2018).

As anticipated by Faludi (2004), urban polycentrism became the central plank of the European Union (EU) Territorial Agenda 2020 (EC, 2011). In the context of perceived global economic competition, the Agenda declared "polycentric and balanced development" to be the "key element of achieving territorial cohesion" and promoting "economic prosperity towards sustainable development" (EC, 2011, p. 6). In contrast to calls from urbanists discussed by McFarlane (2015, 629), "to build density to promote and agglomerate post-recession job creation", recent European Spatial Planning Observation Network (ESPON, 2020, p. 3) advice to policy makers was that "priority should be given to increasing flows and interactions among places over attempts to grow "bigger cities" with more low-return or no-return type investments". Instead of "attempts to build the "Kingdom of Everything" in one place", policy is recommended to focus on "building linkages and joining forces with neighbouring cities and towns in order to "borrow" size and quality, to create a stronger critical mass and ensure positive spill-over effects for the development of wider regions" (ESPON, 2020, p. 2). Meanwhile, other authors have taken the view that evenly developed PURs lack the competitiveness of monocentric regions (for example, Bailey and Turok, 2001; Parr, 2004; Van Oort et al., 2010). Gaps in theoretical and empirical understanding of how agglomeration, density, flows and 'the region' interact, and therefore the justification for the PUR as a spatial 'articulation', 'container' and political 'fix', persist (Jessop, 2000, 2016; McFarlane, 2015, 630). McFarlane's (2015, 632) human geography perspective is that urban density is fundamental to resolving the relationship between topographical space and global network and flow mediated topological space.

Despite an ongoing upsurge in city network analysis in regional studies, important questions remain about the implications of global network economy processes and agential practices for regional spatial development patterns. Recent studies of agglomeration, potential regional

'network economies' and the concept of 'borrowed size', suggest that topographical space and topological space are not distinct, but are interrelated (Burger and Meijers, 2016; Meijers et al., 2016). Martin and Secor (2014, 433) referred to topography and topology as "inseparable states of being" which McFarlane (2015, 632) argued are "always immanent to one another". Reflecting this relational immanence, agglomeration and network economies are not simply substitutable regional development paths but shape the spatial pattern of PURs dynamically (Shi and Pain, 2020). Therefore, as a recent edition of Regional Studies argued, "Rarely is the centrality of cities to regional development questioned, however, understanding the specifics of *how* cities impact regional development remains a critical theoretical and analytical question to regional studies" (Regional Studies, 2018, 1025; Clark et al., 2018).

With the aim of considering how urban density, topography and topology, together impact regional development, our exploration takes note of the growth theory observation that urban infrastructure plays a fundamental part in supporting agglomeration economies (Marshall, 1920). Commercial office real estate is a special class of urban infrastructure on account of its dual role as both a physical place asset and a financial asset that channels mobile capital flows between cities. Office space is the infrastructure that accommodates high skilled labour pools and innovation clusters, generating economic scale and finance capital underpinning powerful twenty first century agglomeration economies in globalized cities (Sassen, 1993, 2018; Glaeser and Saiz, 2003; Florida et al., 2017). As an internationalized and financialized urban asset, densely clustered offices provide the work space for transnational economic agents operationalizing global business networks and intercity investment flows (Cook et al., 2007; Lizieri, 2009). Real estate is fundamentally entwined with the configuration of power and place (Schindler, 2015). As Lizieri and Pain (2014) put it, commercial office real estate is

both *a manifestation of* and *a conduit of* financial flows; it is therefore illustrative of topographical place "fixity [or being]" and, at once, topological network "flow [or becoming]" (Martin and Secor, 2014, 422), and can therefore have relevance for city network economies.

Investment in office infrastructure as a financial asset has come to play a critical role in inter-linking cities and regions to powerful cross-border networks, flows and transnational resources with potential to generate PUR economies (Meijers et al., 2016; Shi and Pain, 2020). However, McFarlane (2015, 632) pointed out that topology should be understood as "given as much to fixity and hierarchy and separation as it is to movement and flow", raising searching questions about the "geographies of urban density, topology, politics and the city" and the PUR. Interest in the implications for cities and regions of the financialization of real estate has recently grown (Halbert and Rouanaet, 2014; Guironnet and Halbert, 2014; Halbert et al., 2014a, b; Henneberry and Mouzakis, 2014). However, little theoretical or empirical attention has so far been paid to the specifics of the association between urban density, the spatial configuration of topological commercial office investment and capital flows, and their relevance for PUR politics and territorial governance. Our article aims to address this deficit by delving into the relationship between commercial real estate investment and density. Despite being frequently mentioned in Territory, Politics, Governance editions, the significance of real estate has been discussed only in passing (D'Albergo et al., 2018; D'Albergo and Lefèvre, 2018; Nelles, et al., 2018). This article is different because it puts real estate front and centre of territory, politics and governance as well as PUR research.

From a theoretical standpoint, we consider academic perspectives that can potentially shed light on relationships between global processes associated with real estate investment

internationalization and financialization, agential practices, capital flows, and urban density. Empirically, we first draw on insights from qualitative evidence on the spatial implications of commercial investment strategies from interviews with senior real estate industry investment managers and developers. The PUR goal of urban agglomeration de-concentration assumes that a topographically proximate but separated polycentric urban pattern of development is associated with a balanced and efficient regional system that counters diseconomies of over-density, such as the spatial concentration of investment associated with monocentric regions (ESPON, 2020, pp. 2-3). If topological real estate investment is positively associated with urban density, this would contradict the topographical logic of the PUR model. Therefore, second, we refer to data on returns on office real estate investment and capital flows for 63 cities in the world as two variables of particular interest. We seek preliminary insights into potential relationships between each of the two variables and urban density variables.

Overall, the findings provide theoretically informed insights into examples of spatial interrelations between topology and topography, and potential efficiencies linked to the configuration of urban and regional space. Relevant for the PUR territorial governance agenda, a spatial dialectic is implied between the normative concept of the morphologically separated, balanced PUR and the reality of topological investment practices and flow geographies mediated by city governments. The article illustrates ongoing gaps in understanding how topology and topography interact spatially to be filled by urban and regional studies. First, contributions to cognate social sciences literatures are drawn on to consider potential interactions between real estate investment global processes, agential practices and urban density. Next, empirical findings from exploratory qualitative real estate actor interviews and quantitative analysis of associations between density variables, office real estate investment returns and capital flows, are considered. Finally, potential lessons

from the analysis and their implications for PUR territorial governance are drawn out in the concluding section.

GLOBAL PROCESSES, AGENTIAL PRACTICES AND URBAN DENSITY

As McFarlane (2015, 629) put it, "density is a keyword in the history of how the city has been conceived and understood". Since the inception of the ESDP (EC, 1999) and the Territorial Agenda, 2020 (EC, 2011), the regional configuration of urban density has been an unstated but fundamental matter underpinning the objective of a "polynucleated" pattern of sustainable spatial development (McFarlane, 2015, 630). Drawing on Hoffman and Thatcher (2019, 141), we argue that this pattern needs to be conceived and understood not only as a matter of topography, separation and distance between urban elements that comprise the PUR "heuristic", but as a matter of spatial processes shaped by urban networks, flows and fixity. As Pain and Hall (2008, p. 1072) found, "the spatial planning concept of the 'polycentric region' (PUR) is overturned when connectivity in the knowledge economy is considered". Our analysis therefore takes into consideration social sciences perspectives that can provide pointers to ways in which the spatial configuration of urban density, contemporary topology and real estate, may be interrelated and impact agglomeration economies and the PUR. We draw on contributions to literature, firstly, on global processes that have increasingly come to shape real estate as a physical urban infrastructure and an international financial asset, secondly, on real estate agential practices and, lastly, on urban governance practices.

REAL ESTATE FINANCIALIZATION AND INVESTMENT INTERNATIONALIZATION – A MONEY BUSINESS

As foreseen by Ullman (1958), the evolution of the world system of large globalized, interlinked cities where labour and business are concentrated has had profound implications

for regional development. During the twentieth century, money has been "collected, tagged and pooled together in public and private institutions that have themselves become integrated into distinctive geographical and institutional hierarchies from the local to the global level" and transformed into finance capital (Clark, 2005, 99). Finance and real estate industry companies with international reach, service global capital by operationalizing flows through built city 'financescapes' across the world (Appadurai, 1996; French et al., 2011). Major globalized agglomerations worldwide are thereby interconnected in a networked capital market that inter-locks urban real estate markets with international financial markets in a technology-assisted dynamic space of flows (Castells, 1996; Lizieri, 2009; Pain, 2018). This confluence of topological processes and topography has implications for the even development of PURs.

Lizieri (2009) first drew attention to global financial and business services as both occupiers of and investors in high-value commercial office space concentrated in 'towers of capital' in the densely built-up financial and business districts of international financial centres. Spatially clustered real estate finance and linked business services are influential agents shaping the geography of cross-border capital flows (Lizieri and Pain, 2014). The integration of finance and real estate services since the late twentieth century noted by Baum (2008), has undoubtedly made commercial office real estate a powerful force in 'building' cosmopolitan cities with aggregate physical and business infrastructure, and international finance capital (Coakley, 1994; Fainstein, 1994). Despite predictions of the 'death of distance' (Cairncross, 1997), physical office space has proved to be a critical requirement for the global organisation of virtually networked financial and business services and has 'grounded' transnational flows of specialized people and capital in the dense, knowledge-laden business districts of 'global' and globalizing cities (Sassen, 1991, 2001; Taylor et al., 2003). In

consequence, as ESPON (2020, p. 6) acknowledged, city level analysis reveals “a much more diverse Europe compared to any observations at country level”.

Simmel warned in ‘The Philosophy of Money’ (1900, cited by Ritzer, 2008), that money is a socially transformative structuring agent. Macro-level analysis has illustrated the transformative effects on cities of the monetization of urban physical property facilitated by new real estate investment vehicles (REITs). Lizieri and Pain (2014, 2015) revealed the concentration of office property assets, finance capital and real estate investment institutions in the largest global city real estate markets. Other macro-analyses have shown that the density of real estate institutions and investment, and the economic structure and built form of cities, are associated (McAllister and Nanda, 2014; Stevenson et al., 2014; Fuertz, et. al., 2015). Econometric studies in the USA have found that density related physical distance and proximity are also important influences on the level of commercial real estate investment returns (Milcheva and Zhu, 2016; Zhu and Milcheva, 2016). Micro-level city analysis has demonstrated that physical proximity between the underlying properties of real estate companies has a significant effect on real estate performance and returns (Milcheva and Zhu, 2018). However, the relationship between urban density, real estate returns performance and capital flows, has been generally under-researched, especially in relation to the PUR.

The global processes discussed so far can be interpreted as structural forces shaping heterogenous patterns of spatial concentration, agglomeration, capital flows and density, and thereby as highly pertinent to PUR geographies of even vs uneven development. At the same time, Sklair’s (2001, p. 1) interpretation of commercial actors as a ‘transnational capitalist class’ of enormous global structural influence on account of their agency, draws attention to the need to understand structural processes as co-constructed by actor transnational practices

in the 'network society' (Castells, 1996). Hoyler et al. (2018, p. 10) recently emphasized the need to incorporate in research, intelligence on the practices of commercial actors, including real estate actors, as key agents *making* cities and regions. We turn next to social theory to help explain agential practices that shape real estate investment, capital flows and density from a topological perspective.

REAL ESTATE INVESTMENT PRACTICES – A SOCIAL PROCESS

Urban social and human geography studies have provided deep insights into the synergies between transnational finance and business services operating through office networks clustered in global agglomerations (for example, Pryke, 1991; Thrift and Leyshon, 1992; Amin and Thrift, 1992, 1994; Pryke and Lee, 1995; Taylor *et al.,* 2003). A number of studies have pointed to an enduring uneven distribution of real estate development and assets across space associated with the concentration of advisors in the largest markets (Henneberry and Roberts, 2008; Lizieri, 2009; Halbert et al., 2014a, b; Stevenson et al., 2014). Office deals by value, investment funds and brokers have been heavily concentrated in just a small number of cities in the world, with London dominating (Lizieri and Mekic, 2018). Concentration in London has been interpreted as rendering it detached from the South East England region and more connected to other global cities in intensifying cross-border commercial real estate financial flows, suggesting the importance of the spatial distribution of real estate development, assets and investment actors for balanced PUR development.

Research into real estate investment actor 'sentiment' and 'familiarity' has illustrated that information flows in actor social networks influence decisions impacting property pricing, time on market and liquidity (Akakandelwa, 2019). Henneberry and Mouzakis (2014) identified a 'familiarity' heuristic adopted by real estate actors clustered in London that

causes an apparently 'irrational' bias in the pricing of London commercial offices and investments given quantitative evidence on actual returns performance compared with other UK regions. This bias is contended to contribute to supply variations and reduced investment performance outside London, and to an uneven pattern of regional development at national and subnational scales. Research by Halbert and Rouanet (2014) indicated that risk aversion might be a strong influencing factor explaining what seems to be counterintuitive investment behaviour. Real estate investment industry perceptions of risk in a global context, offered a potential explanation of the concentration of international investment in London in the 2007-08 world financial crisis (Lizieri and Pain, 2014).

Reference to social theory can assist with teasing out potential reasons behind seemingly irrational actor practices which appear to reinforce urban density and capital flow concentration. In *Le Sens Pratique* (1980 published in English as *The Logic of Practice,* 1990), Bourdieu emphasized the mutual dependencies between structures and agency across space (Sklair, 2005). Actor practices are conceptualised by Bourdieu as unconsciously conditioned and produced through layered social histories that are embedded in urban 'habitus' and, at once, present in geographically wider scale relational 'fields' which, in contemporary globalization, have stretched worldwide (Pain, 2008). According to Bourdieu, actor practices are therefore, to an extent, independent from rational-economic determinants, as illustrated in the case of London's concentration of real estate investment relative to its recorded returns performance. However, Bourdieu also explained how complementary subjective and objective actor practices allow 'social capital' to be commuted to 'finance capital' (see also Lefebvre, 1991). The implication is that depth of social capital and heuristic intelligence in dense international real estate commercial markets constituted by transnational office property occupiers, investors and service suppliers, could be highly relevant to finance

capital, property value, market liquidity, the stability of investment, and returns. Qualitative evidence is required to find out what are the influencing factors on investment practices, their association with urban physical and concomitant densities, and the implications for the PUR.

THE MEDIATION OF REAL ESTATE INVESTMENT AND DENSITY – URBAN GOVERNANCE PRACTICES

A coda regarding actor practices influential in real estate investment is that city governments around the world have not been blind to the significance for economic growth of city property-focused international investment and cross-border flows of capital (D'Albergo and Lefèvre, 2018, 155). As Brenner and Theodore (2002, p. 21) commented, government supported and facilitated urban redevelopment strategies "mobilise city space as an arena … for market-oriented economic growth". In response to intense territorial competition for foreign inward investment to boost growth, city governments have utilized urban spatial planning as a means to collaborate in the operationalization of prestige high-rise urban redevelopment projects 'upscaling' and 'worlding' large cities (Brenner 1998; Ong, 2001).

As a key agent in the regulation of space, planning has come to have an important role in what Rao (2015) referred to as 'infrastructure-making in flux' for purposes of 'anchoring' capital (Peck and Tickell, 2002; Theurillat et al., 2016). Knox and Pain (2010, 420) described how city space has been 'packaged' and 'branded' through public-private collaborations and "piecemeal deal-making" to attract inward investment in high-density redevelopment projects (see also Yeates, 2000). This makes the alignment of spatial planning practices with political economy interests influential in density configuration in permissive and co-creative capacities (Savini et al., 2015), and therefore the "territorialisation of property" (Blomley, 2019, 233) and "political organisation of space" (Agnew, 2013, 1, cited in Jessop, 2016).

Spatial planning has significant statutory powers to control and shape the location, use, height, form and density of development. Under increasing political pressure to mobilize urban space in order to accommodate more real estate assets, planning has become a government co-agent in the development process and the politics of the configuration of density (Forester, 1989; Adams and Tiesdell, 2010; Halbert and Attuyer, 2016; Van Loon and Aalbers, 2017, 221). Belonging to both Sklair's (2001, p. 17) technical and state capitalist class 'fractions', planning has been able to mediate the direction of commercial investment flows to commoditize dense city space. Urban governance practices involving politicized spatial planning, illustrate McFarlane's (2015, 630) depiction of the "networked nature of density" as buffeted both by "the politics and economic imperatives of the day". The politics of city government agglomeration upscaling represents a counter-dynamic to the European territorial objective of balanced regional development and territorial cohesion to be met by "integrated development policies and spatial planning mechanisms" (EC, 2011, p. 10). It is no surprise then that ESPON (2020, pp. 2-4) pressed European "authorities and their leaders [to] play a crucial role in supporting and coordinating cooperation practices" to strengthen "place governance" promoting "polycentric development".

To sum up on what we take from the literature considered, real estate financialization and internationalization have much increased the transnational mobility of capital flows. However, capital flows are also embedded in city office fabric through the actions of key urban actors, including government actors (Bardhan and Kroll, 2007; Lizieri, 2009; Barkham, 2012; D'Albergo et al., 2018). Commercial office real estate investment has a distinctive role in this process due to its insertion in both network economy structural processes and agential practices. Office investment monetizes physical urban infrastructure and directs international

capital flows to densely developed locations associated with global agglomeration economies. Urban office infrastructure and density seem to be co-produced through the agency of private and public sector actors in a neo-liberal paradigm (Tewdr-Jones, 2013, p. 47; Gross et al., 2018). As Blomley (2019) has argued, expert professional knowledge has increasingly brought about the 'situatedness' of property within wider networks of calculation and commodification. However, the apparent dichotomy arising between the 'fixing' of real estate investment and capital in densely developed cities (Jessop, 2000; Dorry and Handke, 2012) and the territorial governance objective of balanced PUR development, remains under-explored in empirical research.

Light is shed next on the conditions influencing real estate investment practices and their association with urban density, drawing on empirical evidence from research conducted by the authors of this article for the Urban Land Institute, the Coalition for Urban Transitions, and a major real estate industry organisation project Steering Group, between 2016 and 2017 (Pain et al., 2018).

EXPLORING ASSOCIATIONS BETWEEN REAL ESTATE INVESTMENT PRACTICES AND THE SPATIAL CONFIGURATION OF URBAN DENSITY

Our investigation explores associations between real estate commercial investment practice and urban density configuration in this article in two ways: first, by reviewing evidence from qualitative interviews conducted with major international real estate investment and development industry senior professional managers; and, second, by exploring two dimensions of investment practice quantitatively − returns on investment and cross-border capital flows - reflecting the financialization and internationalization of real estate respectively. Investigating associations between these specific variables can shed light on the

alignment of the PUR model of topographically distributed, even spatial development, with topological capital distribution and sustainability efficiencies.

INSIGHTS INTO INVESTMENT PRACTICES FROM REAL ESTATE ACTORS

Anonymized data from interviews with twelve respondents of 60-80 minutes duration, provide insights into conditions framing real estate investment strategic priorities and practices relevant to urban density. Collectively, participating companies owned or managed over US$300 billion worth of real estate assets worldwide and were thereby active agents in 'building the cities of the future'. The companies had diverse influential roles in the real estate investment process, reflecting the range of industry fund, consultancy and developer-investor agents shaping international capital flows (Lizieri and Mekic, 2018). Despite this diversity, a high degree of consistency between the responses was found. The main findings are summarised and discussed next.

Manager interest in urban density was found to follow from a need to meet increasing investor demand for property investments that promote "sustainable urban development" as well returns performance. These dual demand-side pressures require the identification of "marketable investment opportunities that meet different client expectations". We were told that managers seek quantitative evidence of a positive correlation between returns on investment and urban density in order to inform:

> Capital market allocations and investment strategy on value, risk and returns, for internal decision making (global strategy, acquisitions, landscape level projects), and for marketing, investor advice, public authority discussions and wider public-private sector collaboration.

The objective is improved understanding of the relationship between density and real estate investment performance, value and risk-adjusted returns, in order to guide both global and "granular" city level property investments:

> Robust commercial quantitative market data, subject to data volume, coverage, collection methodology and comparability" are sought to augment managers' sources of heuristic information which we were told are routinely derived from market intelligence and personal contacts: "quantitative urban form metrics where possible, and a qualitative element for intuitive interpretation … to inform forecasting and underwriting.

The evident value of heuristic information for decision making confirms Henneberry and Mouzakis's (2014) contention that investment is much influenced by social network intelligence and Bourdieu's (1990) interpretation of practice as, in part, independent from rational-economic determinants. However, contrary to the interpretation of decision making leading to concentration of investments in the London market as simply 'irrational', the interview evidence indicates that managers also seek objective, research-based hard evidence on the association between dense cities, sustainable development and risk-adjusted investment returns, in order to "sense check" social network intelligence.

Incorporation of subjective intelligence derived in global cities where financial and business services office occupier and institutional investors are clustered, may be far from irrational if that intelligence provides inductive insights into transnational investor and occupier actor priorities that will impact future property demand, values, market liquidity and risk, spatially. Recalling Bourdieu's (1980) social theory of practice, this inference is indicative of objective and subjective reasoning applied by investment managers being complementary in the

commutation of social capital to finance capital in cities with depth of habitus and connectivity in global network economy relational fields.

Manager interest in global macro-level changes reflected an aim of gaining "insights into future markets and marketable investments in relation to sustainable urban density for diversification". Factors seen as important included:

> Changing population demographics, employment, capital productivity, concentration, infrastructure, connectivity and economic growth, and their relationship to property value, rental levels, and liquidity and risk profiles to increase market knowledge, to identify marketable investment opportunities, and to feed into forecasting and an appraisal tool.

Manager perceptions of global level changes as having relevance for investment strategy indicates that a possible explanation for apparently irrational investment behaviour may be that such structural changes are perceived as significant in influencing potential future shifts in the location of agglomeration and new concomitant market opportunities. Inductive decision making informed by diverse data sources, as opposed to predicted returns based primarily on past performance data, indicates an intended far-sighted approach to investment strategy.

Geographical interest included: "mature and developing markets within Europe, prime markets, such as London, Paris, Brussels, Amsterdam and Berlin", confirming a preference for large cosmopolitan cities regarded as European 'global gateway' cities in the EU level 'territorial fix' (Brenner, 1998; Pain and Van Hamme, 2014; Jessop, 2016). Other interests were: "developing markets, including China, India, South America and Eastern Europe, for

example Poland", indicating interest in the diversification of investment portfolios beyond established mature markets to reflect anticipated future returns to investors.

Manager attention to structural changes underlying the market profile of rising cities in developing markets indicates an intended agile response to global dynamics influencing returns levels. Investment interest is geographically extensive. Specific sectoral interests are in "offices (large cities / prime)" and, for one company, "retail, residential and non-traditional property uses, such as business processing". These interests confirm a general focus on large globalized cities and office markets.

Practical, high-level research-based insights on urban density were sought, "with a forward-looking, global prime A-class investment focus, and considering a range of influencing factors", including:

> What kinds of countries and sectors to invest in? Where is marketable and where is secure for investors? Why do certain cities have good density, e.g. population size, density threshold, land use linked to buildings, offices, balance of green space, transport infrastructure, traffic generation, CO_2 and environmental change, housing supply, location and affordability, amenities, cultural aspects, heritage, quality and design principles? At functional urban region, city and sub-city levels, how do the following contribute to real estate investment value and returns: economic growth, spatial structure, mixed-use, transport infrastructure, commuting, walkability, green space, contiguity of physical development? What would *good* density look like?

These foci illustrate manager recognition of the diverse range and heterogeneity of variables that may have a bearing on sustainable urban density coupled with secure returns to investors.

It is also evident from the responses that established premises concerning the relationship between investment performance and urban density are reflected in informational interests that will feed into future practices. A recursive relationship between investment practices and density which is likely to reinforce prevailing agglomeration economies and capital concentration, is implied.

Though limited by the sample size, the qualitative data from actors managing major international assets, suggest that, under the influence of network economy global structural changes and agential practices, capital flows are inter-locked with large globalized dense cities, leaving less globalized cities behind. This insight confirms the literature reviewed in this article and indicates a dilemma for the normative PUR spatial planning aspiration of balanced, polycentric regional scale development, both in a topological and a topographical sense.

Next, we refer to results from the quantitative analysis of relations between returns on office investment, capital flows and urban density, to augment the qualitative evidence examined.

INSIGHTS INTO RELATIONS BETWEEN INVESTMENT PRACTICES AND URBAN DENSITY

DATA, LIMITATIONS AND METHOD

The quantitative analysis presented next draws on the 2016-17 funded research reported in Pain et al. (2018). In response to current investment industry interest in the association between urban sustainable development, density and returns to investors, the research funder brief specified that a literature review of diverse urban density characteristics be conducted to inform a global comparative analysis of their significance for returns to investors. A

systematic review of 65 international peer-reviewed academic journal articles and reports was undertaken, providing an overview of density variables relevant for incorporation in quantitative analysis.

The literature review highlighted that density is a relative concept which can relate to diverse urban characteristics and spatial scales, complicating its definition and interpretation in relation to sustainable development (see Rapoport, 1975; Bridge, 2009; Tonkiss, 2014). Density can refer to the mix and layout of buildings and floor space, different land and property uses, open vs built space, public vs private space, and the intensity of flows, such as traffic, water, emissions, pollution, etc., that flow into, out of and within urban space over time (see for example, McFarlane, 2015). Densities are generally heterogeneous and spatially uneven, demanding insights into complex interactions, dependencies and causal relations between many variables in relation to time and scale. For example, urban density and compact urban form have per capita per km^2 carbon emissions and air quality efficiency gains relevant for environmental and human health, and economic productivity (Barton et al., 2015; Louis, et al., 2016). However, despite the EC (1999, p. 31) claim that urban spatial polycentrism "makes an important contribution to climate protection through energy-saving from traffic-reducing settlement structures and locations", these gains are subject to spatially displaced emissions generated by intense flows of traffic from settlements beyond the built-up area (Van der Werff et al., 2008; DEFRA/DoT, 2017). Available data are generally at country or city level and there is a general lack of time-series data, confounding assessment of fluctuating city and regional flows and density 'rhythms' (McFarlane, 2015).

A lack of sufficient, robust density data required for a comprehensive global comparative analysis, was found. Not only were relevant data missing for many cities but definitions,

concepts, analytical frameworks, methods and reporting processes used, and data reference years, varied across countries and between data suppliers. Accordingly, the focus of our analysis in this article are the correlations found between commercial office real estate returns, capital flows and seven density variables for which there was strong evidence of their relevance for sustainable development and data robustness validation: 'urban extent', built-up area', 'open space ratio', 'business services', 'financial services', 'innovation' and 'green environment' (definitions and data sources are listed in the Appendix). The data used in analysis were the most recent available for the year 2016. The sources and limitations are elaborated further in Pain et al. (2018).

Data available to capture the dynamics of commercial office real estate investment and returns since the year 2008 were CBRE real estate yields data used to calculate returns on office investment and Real Capital Analytics (RCA) data on cross-border real estate portfolio deals which channel international capital flows. In the dataset used, there is limited information on the properties themselves, but the average cap rate (where recorded) indicates that the sales are of prime (class A) office assets. Our global comparative analysis incorporates the 63 cities worldwide having available data, reflecting an absence of data for cities with emerging office markets (see also Lizieri, 2009, p. 300; Lizieri and Pain, 2014). Due to the general lack of internationally consistent numerical value and time series data for density variables, multivariate analysis was not possible. Therefore, relationships between dependent and independent variables were examined in turn using a Spearman nonparametric rank correlation analysis. The 'ρ' value, or Spearman correlation coefficient for the relationship between a dependent and each independent variable was established monotonically for the 63 cities in the analysis. A Pearson correlation check was run to check the validity of the rank correlations in the absence of comparable density longitudinal data at

a global level. The results did not contradict the correlation results however no causal directions or predictive inferences can be deduced from the correlations.

RESULTS AND ANALYSIS

Table 1 shows that dense compact urban spatial configuration represented by built up area density and urban extent density, is significantly correlated with higher returns for real estate investors. These two variables are positively correlated by almost 70% with average investment returns on commercial office real estate, indicating that physical density matters for returns on investment. Weaker significant positive correlations are also shown between office investment returns and global business services (36%), innovation (32%), and financial services (31%), suggesting a relationship between returns on investment and network economy efficiencies. Green environment is also significantly but less strongly correlated with returns (29%).

Overall, the correlations reveal strong associations between higher returns and 'hard' density (physically compact urban form), and associations with 'soft' density (business and financial services, innovation and environmental quality). Figure 1 shows the return rates for the 63 cities in the analysis. It is clearly seen that the high return cities are major agglomerations in Northwest Europe, the American Northeast Seaboard, American Bay Area, and China Coastal Region.

Figure 1 to go about here

Table 1 shows very different results for correlations between flows and urban density variables from those for returns. City level physical density is not found to be significantly

related to capital flows. Instead, capital flows into office real estate are shown to be most associated with innovation, which is correlated by 68%, and global business and financial services which are also highly correlated with investment flows at 52% and 50% respectively. These results indicate a strong relationship between capital flows and network topology efficiencies. The results suggest that the soft density innovation and quality of services of a city matter for transnational capital flows as opposed to traditional hard physical measures of dense urban form at the city level. Figure 2 shows the different distribution of capital flows into office property across the 63 cities from that for office returns. Whereas Hong Kong, Singapore and Mumbai have the highest return rates, London and New York dominate for flows.

Figure 2 to go about here

A limitation of the analysis is that satellite data used in order to allow global comparability of city physical density (see Appendix), do not take into account the heterogeneity of property uses, heights and occupancy within an urban area necessary to quantify the relationship between landscape level built form density and capital flows. However, global business and financial services which are positively correlated with capital flows, can be expected to be a surrogate for Grade A commercial office space supply which is concentrated in high density 'skyscraper' city business and financial districts. Data on the highest value office deals for the period 2007 to 2014 for London and New York, endorse that the focus of major capital flows is property in physically densely developed city locations at the intra-urban level, revealed by existing qualitative studies to have proximity and clustering efficiencies for doing global business.

Overall, we see that urban hard, physical density which is most significantly associated with office returns performance at a city level, also has relevance for the distribution of office investment flows within the two cities in the world having the highest flow volumes.

CONCLUSION - IMPLICATIONS OF A TOPOLOGICAL PERSPECTIVE FOR PUR GOVERNANCE

In this article we have referred to the concept of topology to explore theoretically and empirically, a specific aspect of *how* "cities impact regional development" (Regional Studies, 2018, 1025). Our focus on the relevance of real estate for urban density in relation to the PUR has reflected the dual role of investment in commercial office assets as a topological conduit of capital flows and a topographical manifestation of those flows (Lizieri and Pain, 2014; Martin and Secor, 2014, 422). Our review of relevant contributions to cognate social sciences literature points to interdependencies between structural processes and agential practices likely to be instrumental in the spatial congruence of transnational real estate investment, global agglomeration economies and urban density. The ambivalent role of spatial planning as an agent of state politics in city level 'territorialization of property' on the one hand, and as a visionary for the spatially balanced 'polynucleated' region on the other hand (McFarlane, 2015, 630; Blomley, 2019, 233), is indicated by literature within and beyond the planning discipline (Agnew, 2013).

Qualitative evidence from interviews with senior real estate actors lends support for understanding commercial office investment as risk-averse and recursively associated with perceived geographies of urban density and agglomeration. Actor descriptions of influencing factors on global and property level investment strategies are in line with social sciences interpretations of structure and agency as mutually dependent upon one another. The value

attached by actors to risk relevant intelligence drawn both from macro-level market research and social networks, is indicated as a potential explanation of the disconnection noted in real estate literature between past returns performance and foresight-oriented investment practices. Interview evidence indicates that the real estate literature interpretation of investment concentration as reflecting the locational embeddedness of major investment actor social networks, overlooks the perceived value attached by actors to insights into potentially fluid office demand drivers. The sectoral and institutional composition and scales of social networks that influence investment practice, merit further qualitative investigation.

The literature review and qualitative analysis imply that the established geography of agglomeration and density, and potential global shifts, conjointly and iteratively influence real estate investment practices. The recursive nature of relations between the configuration of urban density, structural processes and investment practices in time-space, and their implications for determining directions of causation, is an under-explored challenging research area. Accordingly, we conclude that answers to semi-rhetorical questions of causality – whether form follows finance, or finance follows form (Wills, 1995), and whether form follows function or function follows form at a regional scale (Burger and Meijers, 2012) - remain unclear.

Our quantitative exploration of relations between commercial office real estate investment and urban density variables, highlights analytical challenges for global comparative assessment of causalities due to gaps in data and different density definitions and methodologies applied internationally. However, the findings illustrate the added value of bringing real estate more to the fore in debates over territory, politics and governance. The Spearman rank correlation approach adopted reveals that, at a city level, hard physical urban

density is most significant for returns on real estate office property investment, whereas soft density – innovation and connectivity in global business and financial services networks - is most significant for office capital flows. Major capital flows are focused on property in high-density 'towers of capital' (Lizieri, 2009) in business and financial services districts at an intra-urban level.

The results are illustrative of spatial relations that are hybridized in complex ways both by topological and topographical spatial processes. Capturing this complexity in quantitative analysis taking spatial scale into account is problematic, especially in a global analysis, as we discovered in our explorative research. Nevertheless, our attempt at quantification illustrates how using a topological lens in analysis can assist with filling theoretical and empirical gaps in real estate understanding of how hard and soft density relevant to commercial office space demand, influence returns on investment and capital flows. Differences between return and flow levels and their association with hard and soft density variables for specific cities, require further investigation incorporating landscape level, granular time series data and qualitative assessment. The relationship found between green environment and returns, indicates that environmentally sustainable development should be subject to further research to inform strategic spatial planning and office occupancy, value and investment performance risk modelling.

Taken together, the findings from our exploratory approach indicate potentials for incorporating real estate and topologically and topographically refined density definitions and metrics in future urban and regional analysis. We suggest that this is necessary to inform an apparent conflicted territorial politics of the PUR space of governance. Real estate topological investment and capital flows mediated by spatial planners serving city

governments, chime with urban spatial concentration and agglomeration economies. We conclude that the PUR territorial governance agenda of regionally balanced development is in a dialectical relationship with the topology and politics of the city.

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Figure 1 Global distribution of office real estate investment returns

Note: The size of the nodes represents the return rate.

Figure 2 Global distribution of office real estate capital flows

Note: The size of the nodes represents the volume of capital flows

APPENDIX

Density variable definitions and data sources

Variables	Description
Urban extent density	The ratio of the total population of the city and its urban extent, measured in persons per hectare (source: Atlas of Urban Expansion (AoUE) http://www.atlasofurbanexpansion.org/).
Built-up area density	The ratio of the total population of the city and its built-up area, measured in persons per hectare (source: AoUE: http://www.atlasofurbanexpansion.org/).
Open space ratio	The share of city captured and fringe open space including rivers, lakes and canals, in a given area (source: AoUE: http://www.atlasofurbanexpansion.org/).
Financial services density	A quantitative measure of global financial services concentration based on the aggregated location strategies of leading financial service firms across cities (source: Globalization and World Cities Research Network (GaWC): https://www.lboro.ac.uk/gawc/).
Business services density	A quantitative measure of global business services concentration based on the aggregated location strategies of leading business service firms across cities (source: GaWC: https://www.lboro.ac.uk/gawc/).
Innovation density	A measure of innovation potential based on pre-conditions including jobs, lifestyle, economic development, favourable investment (source: 2Thinknow Innovation Cities Index: http://www.innovation-cities.com/innovation-cities-index-2015-global/9609).

Green environment	A comprehensive environmental index including greenhouse emissions, natural catastrophe exposure, green space, energy use, renewables share, drinking water, waste management, sanitation (source: Arcadis (2016) Sustainable Cities Index: https://www.arcadis.com/en/global/our-perspectives/sustainable-cities-index-2016/).