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Exploring External Urban Relational Processes: Inter-city Financial Flows Complementing Global City-Regions

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Abstract:

External urban relations are commonly described as one of two types: hierarchical local hinterlands (central place theory) and networked non-local hinterworlds (central flow theory), referred to as town-ness and city-ness, respectively. This paper builds on and develops these generic concepts to make them specifically relevant to today's corporate globalization. The central place process is represented by multi-nodal global city-regions, and the central flow process is represented by inter-city capital investment flows. We find that capital flows in global cities increase flows to proximate smaller cities within their regions. This empirical link between city-ness and town-ness has theoretical and policy implications.

Key Words: Advanced Producer Service; Central Flow Theory; Central Place Theory; Foreign Direct Investment Flows; Global Cities; Regional Cities.

JEL Classification Codes: R11, R12, O18

Exploring External Urban Relational Processes: Inter-city Financial Flows Complementing Global City-Regions

Introduction

At the beginning of his magisterial history of the City of London, David Kynaston (2011, 23) references a division between the 'town' in the west end of London and the busyness of the 'city'. This geographical distinction is between two contrasting commercial clusters: the first servicing the needs of Londoners – later more broadly known by the American term 'downtown' – and the second providing business services beyond London – to become definitively known as 'The City' with its worldwide range. This linking of the local urban economy with town-ness and the wider urban economy with city-ness is the basis of a reformulation of the urban external relations as two distinct processes: central place theory (CPT) and central flow theory (CFT), respectively (Taylor et al., 2010). This paper contributes to further elucidating these separate but related spatial processes through both theoretical/conceptual refinements and a new empirical/policy illustration.

CPT and CFT have very different provenances. CPT was developed by Walter Christaller (1933/1966) as a model of urban centres servicing their rural hinterlands. He developed a theoretical hierarchical structure, which he illustrated as regional urban systems for 1920s southern Germany. Anglophone geographers took up this structure in the second half of the twentieth century, they converted his theory into the study of 'national urban systems' as tools for state economic planning (Berry and Horton, 1970; Bourne, 1976). Thus, CPT dominated the study of urban external relations, but the interest in it declined after about 1980. In the meantime, urban external relations began to be studied at a global scale starting with Friedmann's (1986) world city hierarchy and Sassen's (1991) 'global city' and leading to 'world city network' analysis (Taylor, 2001, 2004). With its emphasis on network relations, the latter was called CFT in Taylor et al. (2010) to emphasize its different take on urban external relations. In Castells' (1996) terms, it means moving from spaces centred on places to spaces centred on flows. Bringing the two theories together, CPT was interpreted as describing local urban external relations (hinterlands), or town-ness, and CFT was interpreted as describing non-local urban external relations (hinterworlds), or city-ness. Both theories describe spatial processes that can be found in all urban settlements but with larger settlements tending to encompass increasingly more central flow processes (Taylor and Derudder, 2016, 43).

It is hard to imagine such contrasting research provenances: one largely rural southern Germany in the first half of the twentieth century, which was later nationalized, to the other globalization in the twenty-first century. Nevertheless, the key point is that each theory has been recognised as depicting generic processes, and each describes urban external relations for all urban settlements whenever and wherever (Taylor, 2013; Derudder and Taylor, 2018; Taylor and Hoyler, 2020). In this paper, we provide a contemporary development of both central place and central flow processes. For the former, we provide a theoretical/conceptual shift to multi-nodal city-regions as local urban relations. These were identified as typical urban products of corporate globalization in Allen Scott's (2001) 'global city-regions' and subsequently analysed in detail as Hall and Pain's (2006) 'polycentric metropolis'. For CFT, we implement an empirical/policy shift from an initial focus on inferred business flows using service firms' office networks to actual capital flows. Since investment flows into large cities can have regional spillover effects on proximate smaller cities, this paper provides an integration of the central flow non-local process with the central place local process through the lens of global city-regions.

Figure 1 is a schematic diagram depicting the complementarity of the central place and flow processes that we are investigating. The world city network is represented by global cities and their inter-relations, with each of these cities providing city-region hubs for their regional cities. This model is operationalized as follows. First, we use Foreign Direct Investment (FDI) flows as a direct measurement of interurban relations created as capital flows between cities. FDI contributes to the transnational labour supply and trade and to the transfer of capital, high value-adding skills and knowledge (Branstetter, 2006; Liu, 2008, Blonigen and Piger, 2014) and can arguably contribute to local economic growth (Borensztein, 1998; Wen, 2014). CFT was originally specified through using the activities of advanced producer service (APS) firms; we are able to show that by using city level FDI data, including both Greenfield Investment (GI) and Mergers and Acquisitions (M&A) in 247 OECD cities, inter-urban equity flows can be mapped on the relations between cities generated by APS firms. This validates the shift to capital flows in the specification of CFT. Second, in addition to the network externalities derived from inter-city relations, there are agglomeration externalities shared locally in city hinterland structures (Meijers et al., 2016). Although it has been argued that CPT has reduced relevance in the network paradigm (Blotevogel, 1996; Burger et al., 2014), we counter this by shifting the focus to the externalities of urban relations at a hinterland level. Taking OECD cities as a data sample, we show that the world city network interlocked between global cities where APS firms are located can regionally affect FDI capital inflows to geographically proximate cities.

<< Figure 1 about here>>

Thus, first, transnational APS firms in global cities create horizontal network relations between global cities at the world level. Second, they facilitate the formation of a hierarchical structure of inter-urban relations at the local level: capital first flows into the global cities and then spreads to proximate regional cities via a vertical structure. We find a capital flow hierarchy, which measures the urban hinterland interactions, surrounding the APS global cities. Our analysis brings complexity into the CPT hierarchical explanation of global city-region relations. The results provide empirical evidence that CFT cannot be regarded as a mere replacement for CPT; rather, it is complementary to it, as shown in Figure 1.

Our argument proceeds in three substantive sections beginning with our take on clarifying the theoretical and conceptual confusions in research on external urban relations. This is followed by a description of the new data – capital flows - we use to further develop understanding in this research field. The main section provides unique analyses of relations between major cities and between said cities and proximate other cities based upon econometric modelling of the capital flows. A brief conclusion summarises our contribution to current debates in the field.

Linking central flow and central place processes

Taylor et al.'s (2010) introduction of CFT in relation to Christaller's (1933/66) CPT, and consequently our theoretical/conceptual shift, are both part of broader debates on whether agglomerations or their interactions should be the prime focus of analysis in contemporary urban and regional studies. As Van Meeteren et al. (2016) stated, evidence of the importance of these debates is that they have been addressed in some of the most heavily cited papers in the field in the 1990s and the 2000s (for example, Amin and Thrift 1992; Bathelt et al. 2004).

There is a general consensus in the literature that both CFT and CPT matter. However, Marshall's (1920) famous treatise on urban agglomeration economies led to a prolonged urban economics focus on intra-urban processes and endogenous growth without a corresponding focus on inter-urban processes. The urban characteristics underpinning urban economic growth from a Marshallian perspective were proved to be fundamental for the development of Sassen's (1991, 2001) global cities and inter-city relations in the world city network (Taylor, 2004). With reduced barriers to transnational trade, accumulated human capital, knowledge, specialised producer services, capital investment and the depth of urban infrastructure in Hall's (1966) pre-globalization 'world cities' were essential ingredients for the unleashing of non-local, inter-urban relations. In the late nineteenth century globalizing world system, indigenous urban agglomeration economies became the critical resources required by commercial agents servicing global capital (Wallerstein, 1974; Braudel 1985; Friedmann, 1986; Bathelt and Taylor, 2002). It can be argued that the high transnational mobility of skilled labour, knowledge and capital associated with globalizing APSs has contributed significantly to the interdependency between city network effects and agglomeration economies (Castells, 1996, Capello, 2000; Meijers, 2007). As Allen (2010, 2898) stated, corporate network relations translate to interactions and complementary relationships between cities:

> "(c)ity powers, if one can put it like that, are mobilized through networks; it is the forms of interaction and exchange which take place through a complex of networks which are constitutive of a city's powers. In cities like New York and Tokyo, high-level professional working in banks, overseas finance houses, law firms, and the like mobilize their economic powers through the financial and business service networks;

> through the co-present interaction which enables them to shrink the space and time between each other and to construct closer, integrated ties and relationships.”

Transnational corporate network organisation has posed an apparent dilemma for governments worldwide. Policy initiatives seeking to leverage high-value global network flows by ‘worlding’ leading agglomerations on the one hand and to rebalance uneven ‘core-periphery’ development by promoting spatially ‘polycentric’ urban regions on the other hand have seemed fundamentally contradictory (Halbert et al., 2006; Ong, 2011; Pain and Van Hamme, 2014). Interlocking network model (INM) analysis of transnational APS geographies provides a lens for observing how capitalism is structured across cities worldwide and whether the influence of the global APS network can spread between global and proximate cities, potentially promoting horizontal relationships and regional economies. Together with urban agglomeration processes, city network processes have come to be recognised as critical foundations for the development of integrated markets, inter-urban and multi-scalar network relations and flows (Meijers and Romein, 2003; Mahroum et al., 2008; Pain and Van Hamme, 2014; Bassens and van Meeteren, 2015; Taylor et al., 2014; Doran and Fox, 2016; Zhang and Kloosterman, 2016; Xu et al., 2018; Shi et al., 2019; Shi and Pain, 2019). However, in which ways and to what extent local urban hinterland interactions and non-local inter-urban network relations are relevant analytically, both separately and conjointly, continue to be the focus of considerable empirical and conceptual research (Meijers et al., 2016).

A growing number of studies have suggested that agglomeration economies associated with global city functions have the potential to spill over to surrounding urban centres in polycentric regions (Coe and Townsend, 1998; Hall and Pain, 2006; Meijers, 2007; Pain, 2008; Taylor et al., 2008; Burger and Meijers, 2012, 2016; Burger et al., 2014; Meijers et al., 2016). For instance, London's supreme global APS network relations have been found to interlink it with much smaller regional cities, such as Reading, which also have APS network relations that bypass London (Pain, 2008; Crampton et al., 2010). Insights into the role of 'self-sustaining' hinterland 'middle places' located at the 'periphery' of the spatial influence of central places have been speculated to integrate knowledge resources from different central places and function as a fulcrum connecting other hinterland cities and promoting regional network capital (Mulligan, 1984; McCann and van Oort, 2009; Doran and Fox, 2016; Huggins and Thompson, 2014; Shi, 2018).

Although London and New York have strong global functional roles as a financial business city and a financial innovation city respectively (Taylor et al., 2014), Martinus et al. (2015) found that globalizing regional or 'middle layer' cities can have a functional role linking nationally and globally articulated networks, serving as active pathways for capital and information flows within regional- and industry-specific sub-networks. However, analysis of the relations of Europe and its neighbouring countries in diverse global networks and flows found that proximity and local relations remain key determinants of the urban functions for many medium-sized cities, even in economically developed 'core' regions (Pain and Van Hamme, 2014; Pain et al., 2015). Meijers et al. (2016) found that in western European core regions, while the spread of metropolitan functions is driven both by agglomeration size and increased inter-city network 'connectivity', the former remains the most significant determinant for most types of urban functions. It would seem that global cities retain the command-and-control functions of the global corporate hierarchy as 'basing points for capital' in an essentially hierarchical regional spatial order of cities (Martinus et al., 2015; Sigler & Martinus, 2017).

The ongoing debate surrounding the juxtaposition of global and regional city network relations lacks evidence to clarify spatial policy confusion. For example, recently, the European Spatial Planning Observation Network (ESPON, 2020, 2-3) advised its member states with very different regional economic development profiles (Pain and Van Hamme, 2014) to "create a stronger critical mass and ensure positive spill-over effects for the development of wider regions", policy should counter "the 'Kingdom of Everything' in one place". The theoretical premises underpinning spatial planning initiatives can have a powerful influence on agile international investment flows, which can be counter-productive if not well-founded (Halbert et al., 2006; Pain et al., 2020). The gap in the evidence regarding global city agglomeration and regional spillovers in spatially hierarchical hinterlands points to a compelling case for further CFT/CPT process investigation to get "our theories and concepts in proper order" (Taylor et al., 2010, 2018).

Of course, the city-ness vs town-ness conceptual distinction noted by Taylor et al (2010) represents a stylized approach to analysis, as illustrated by Phelps (2017). However, reflecting Castells (1996) 'space of flows' versus 'space of places' dichotomy, referring to this theoretical binary premise in an empirical study allows one to raise fundamental questions about the potential complementarity of the central flow and central place processes to be addressed (Humer and Graqvist, 2020). Inter-city equity flows provide a way to empirically analyse the geographies of city interlocking processes in a regional context. M&A deals are representative of long-term inter-organisational relations and are linked knowledge and capital flows (Shultz, 2007; Lee and Lieberman, 2010). Studies in recently globalizing and established global city-regions have illustrated the special significance of such flows for inward investment, agglomeration economies, positive externalities, and integrated city ties and relations. They can interlock economic entities potentially involving local business services joining larger cross-border APS networks in consolidation strategies (Rodriguez-Pose and Zademach, 2003; Cook et al., 2007; Shi and Pain, 2019). Together, FDI, greenfield and M&A deals can underpin hinterland development patterns and potential network economies. Accordingly, in this paper, first, we examine whether direct flows of capital can be mapped onto the cross-border connections of cities generated by transnational APS networks and, second, whether capital flows to APS agglomerations have hinterland spillovers.

Data

Our data sample begins with 300 cities with the largest economic size, as measured by GDP, in 33 Organisation for Economic Co-operation and Development (OECD) countries. Cross-border direct investment flow data are collected from two sources. We consider two common modes for foreign direct investments (FDI): greenfield investments and international acquisitions. Our greenfield investment flow data are collected from the Financial Times fDi Markets database. The cross-border M&A flows data are from the Zephyr database. We merge the two databases and aggregate the total cross-border direct investment flows across cities over the period from 2003 to 2018. We also collected data on the macro-economic variables for the source and destination cities from OECD database and the World Bank database. Due to missing data on income and other economic variables, our sample was reduced to 247 cities.

Among the 247 cities, 103 cities are ranked in the Globalization and World Cities (GaWC) list published in the year 2000 (Taylor, 2004). In the 2000 version, GaWC calculated the service values of 100 global APS firms distributed across 315 cities worldwide. Despite subsequent and recent GaWC world city network analyses (e.g. Derudder and Taylor, 2020), to avoid the endogeneity issue, we use these data collected in 2000 to ensure that the location of these firms will not be affected by the capital flows between cities. We refer to the 103 cities as ‘global cities' while the remaining cities are referred to as 'regional cities'. Based on the APS location and the service value[i], we follow Taylor (2001) and calculate the APS connectivity between each pair of global cities:

$$r_{i,j}^{APS} = \sum_{p=1}^{100} APS_{p,i} APS_{p,j} \tag{1}$$

where $r_{i,j}^{APS}$ represents the APS connectivity between global cities i and j. $APS_{p,i}$ denotes the service value of APS firm p in city i. The maximum connectivity is 1292, which is between New York and London (Table 1).

Table 1 reports the summary statistics. As expected, based on the literature, global cities attract more investment inflows. On average, 40.2 billion USD foreign investment flows into global cities, over ten times the flows to regional cities (3.1 billion USD). Over 50% of foreign direct investments are from the advanced services sector[ii]. Global cities have an average service value of 76. By examining the economic variables, we can see that global cities also have significantly greater economic size, as measured by GDP per capita; global cities also have a higher income and a higher population density. The FDI flows between global cities amount to 21.2 billion USD on average, over ten times more than those to regional cities. The average flows from regional to global and between regional cities are only 9 billion USD and 2 billion USD, respectively.

<< Table 1 about here>>

Figure 2 illustrates the total foreign direct investment flows across the 247 cities. The strength of the capital flows is represented by the width of the lines connecting these cities. The size of the dots represents the centrality based on the total FDI flows, which is measured by the degree of inflows:

$$c_i^{FDI} = \sum_{j=1, j \neq i}^{247} FDI_{i,j}, \qquad (2)$$

where $FDI_{i,j}$ represents the total direct investment inflows. We further investigate the relationship between FDI and APS connectivity. Similarly, the APS centrality is calculated as the weighted in-degree of the APS connectivity:

$$c_i^{APS} = \sum_{j=1, j \neq i}^{103} r_{i,j}^{APS}, \qquad (3)$$

The correlation coefficient between the total FDI inflows and APS connectivity centrality is 0.745. Cities that are more connected in the world city network, such as London and New York, are more likely to attract foreign capital, as illustrated in Figure 3. The network of connections, ties and flows would underpin a city's leverage as a competitive territorial entity (Thompson, 2003, Allen, 2010).

<< Figure 2 about here>>

<< Figure 3 about here >>

Analysis

Econometric Modelling

We use a gravity-type model to map the investment flows on APS connectivity. We also include capital flows to nearby cities to capture the urban-hinterland interaction:

$$FLow_{i,j} = \exp[a + \beta \ln(r_{i,j}^{APS}) + \delta D_i^R \ln(\sum_{l=1}^{103} w_{i,l} FLow_l^G) + \rho D_i^R \ln(\sum_{k=1,k\neq i}^{144} w_{i,k} FLow_k^R) + \tau D_i^G \ln(\sum_{l=1}^{103} w_{i,l} FLow_l^G) + \theta D_i^G \ln(\sum_{k=1,k\neq i}^{144} w_{i,k} FLow_k^R) + \delta \ln(Dist_{i,j}) + \gamma_1 \ln(Econ_i) + \gamma_2 \ln(Econ_j) + D_i + D_j + \ln(e_{i,j})] , \quad (4)$$

where $FLow_{i,j}$ represents the total FDI flows over the period from 2003 to 2018 across the 247 OECD cities. $r_{i,j}^{APS}$ is the connectivity created by the service value of 100 APS firms between cities *i* and *j*. β captures the impact of the APS connectivity on cross-border capital flows. It should be noted that $\ln(r_{i,j}^{APS})$ is essentially only relevant for global cities since the APS connectivity for regional cities is zero[iii]. $\sum_{l=1}^{103} w_{i,l} FLow_l^G$ is the FDI flows to global cities weighted by the geographic distance to destination city *i*. $w_{i,l}$ is defined as the inverse of the distance between regional city *i* and global city *l* ($d_{i,l}$): [iv]

$$\begin{cases} w_{i,l} = \frac{1}{d_{i,l}}, & i \neq l, and\ d_{i,l} \leq S \\ 0 & otherwise \end{cases} , \quad (5)$$

where S is the bandwidth. We set S as 600 km because this number generates the highest predictive accuracy, as measured by the lowest Pearson result. $w_{i,l}$ is then standardized between zero and one.

$\sum_{k=1,k\cong i}^{146} w_{i,k}\ FLow_k^R$ is the average capital flows to other regional cities weighted by the distance to the destination city *i* ($d_{i,k}$):

$$\begin{cases} w_{i,k} = \frac{1}{d_{i,k}}, & i \neq k, and\ d_{i,k} \leq S \\ 0 & otherwise \end{cases} . \quad (6)$$

$D_i^R \ln(\sum_{l=1}^{103} w_{i,l} FLow_l^G)$ and $D_i^R \ln(\sum_{k=1,k\neq i}^{146} w_{i,k} FLow_k^R)$ measure the influence of the flows to nearby global and regional cities on the regional cities, where D_i^R is a dummy variable equal to one if the destination city is a regional city. δ and ρ are the corresponding coefficients, which capture the impacts of flows to nearby global cities and regional cities, respectively, on a regional city. Similarly, we also quantify the influence of the flows to nearby cities on the global city using $D_i^G \ln(\sum_{k=1,k\neq i}^{103} w_{i,k} FLow_k^R)$ and $D_i^G \ln\left(\sum_{l=1}^{146} w_{i,l} FLow_l^G\right)$, where D_i^G is a dummy variable with a value of one when the destination city is a global city and zero otherwise. τ and θ capture the impacts of flows to nearby global cities and regional cities, respectively, on a global city.

$Dist_{i,j}$ represents a set of variables measuring the 'distance' between cities i and j, including the legal system, the language, and the geographic distance between the two cities. δ is a vector of coefficients for the 'distance' variables, which are supposed to be negative. We also include city-level push and pull factors ($Econ_i$ and $Econ_j$). The economic variables include the GDP growth rates of the two cities, the share of city GDP with respect to the country GDP, income per capita and population density. γ_1 and γ_2 measure the impacts of the economic conditions of the destination and source cities, respectively. To account for institutional factors, we also include the country dummies. $e_{i,j}$ is the error term.

Given the problem with the potential zero capital flows between cities, the ordinary least squares method may be biased and inconsistent (Silva and Tenreyro, 2006; Brodzicki and Uminski, 2018). Alternative estimators include the Poisson Pseudo-Maximum Likelihood (PPML) estimator and the Heckman sample selection estimator. However, since the Heckman sample selection estimator highly depends on the selection of the instrumental variable, we choose the PPML method. In addition, due to the heteroskedasticity, the estimator can be inefficient; therefore, we report the Newey-West heteroskedasticity robust standard errors.

Inter-urban Relations

As reported in Table 2, column 1, we find a significant positive relationship between APS connectivity and cross-border investment flows, confirming the assumption that the shared presence of an organization in any pair of cities presents the potential for inter-city interaction. A one percentage increase in APS connectivity is associated with a 0.68 percentage increase in capital inflows to global cities.

Because all APS firms are from the advanced service sector, some of the foreign investments can be expected to be enacted by these same firms. In order to investigate how APS firms can oil international investment flows in non-APS sectors, we exclude the FDI flows in the advanced service sector. As reported in column 2 of Table 2, the presence of services from transnational corporations can not only lock capital in the APS sector, but they can also facilitate the transfer of capital to other non-APS sectors. A one percentage increase in APS connectivity is associated with a 0.62 percentage increase in investment flows to non-APS sectors.

Additionally, as shown in Table 2, investment flows increase with a shorter geographic distance and superior economic conditions (higher GDP share, higher income in the destination and/or source city, and a higher population density). Furthermore, the Park test result has a confidence interval below 2 in the Model with all sector FDI, indicating that the assumption of a constant mean-variance ratio is violated (Head and Mayer, 2014). Thus, heteroskedasticity robust standard errors should be used. The over-dispersion test (Wooldridge, 1997) is insignificant, indicating that data are not overdispersed.

<< Table 2 about here >>

Urban-hinterland relations

The four coefficients δ, ρ ,τ and θ in Equation (4) reflect the urban-hinterland interactions. δ and ρ capture impacts of flows to nearby global cities and regional cities, respectively, on a regional city, while effects of flows to nearby global cities and regional cities on a global city are indicated by τ and θ, respectively. We find that capital inflows to nearby global cities significantly increase the capital inflows to the destination regional city while the impact from the capital inflows to nearby regional cities is insignificant. A one percentage increase in the flows to nearby global cities is associated with a 0.13% increase in the investment flows to the regional city (column 1, Table 2). Excluding the investment flows within the advanced service sector generates a similar conclusion, as shown in the second column in Table 2. However, we do not find a significant impact of the capital flows to geographically nearby cities on the global cities. Global cities are interlocked by the world city network, confirmed by the significant coefficient for APS connectivity [v]. This result reconfirms Hall and Pain's polycentric metropolis conclusion that the "spatial structure (is) polycentric and hierarchical at the same time" (Castells, 2010, IV).

This analysis provides empirical evidence of a missing link between city-ness and town-ness, which gives rise to a polycentric regional capital investment structure. The increase in capital inflows to much smaller cities surrounding global cities provides empirical evidence of a second source of regional investment expansion that is unacknowledged in territorial policies pursuing a simple model of spatially balanced urban development as the way to promote regional economies. This second source of regional investment expansion identified in our analysis – direct flows of capital – is shown to be empowering global cities to share agglomeration externalities with hinterland cities, as suggested by Meijers et al. (2016). Flows of actual capital thus provide an important additional policy relevant metric for understanding the external relationships between global and regional cities in a polycentric hinterland structure.

Figure 4 illustrates how external city-ness relations in global networks can be a powerful force at the hinterland level. High investment flows to London that spread to smaller cities, such as Reading, Portsmouth, Oxford and Rochester; or from New York to Providence, Worcester, New Haven, and other median-sized cities in the Boston–New York–Washington corridor may form functionally polycentric urban region hierarchies. On the western coast of the United States, cities including Sonoma, San Joaquim, and Monterey are in an area of influence of San Francisco and Los Angeles. Similarly, flows to Munich may spread to Ingolstadt, Regensburg and Augsburg, especially in the high-tech sector. Within the Japanese Tokyo–Toyota megacity region, investment flows to the two global cities may influence flows to Taksaki, Kofu, Numazu, etc. The functional relationships between global and regional cities may well not follow one single universal logic; rather, they may depend on specific APS characteristics, urban systems, state regulations, etc., where public (e.g., urban planners) and private sector actors (e.g., real estate developers) meet (Hoyler et al., 2018).

<< Figure 4 about here >>

Robustness Tests and Discussions

Concerns may arise that the investment attracted to global cities (e.g., London) may actually flow to nearby regional cities (e.g., Reading). The global cities may just act as a hub to distribute these flows to regional cities. We argue that this will not seriously bias our empirical results. First, the destination of the investment flows is based on the location of the new project in greenfield investments and the location of the target company in M&A investments. In other words, our investment inflows are based on the exact location of the receivers. Second, our investment flows are foreign investment flows. Thus, the flows from global cities to domestic nearby regional cities are not included in our dependent variable. To more carefully address this concern, as a first robustness test, we subtract the global to regional city flow from the total inflows to the global cities. In other words, in Equation 4, we exclude the flow from global city j to the regional city i from the summation with l. The results are reported in Table 3, Column 1. Panel A is for all sector FDI flows, and Panel B is for non-APS FDI flows. As shown in Table 3, our results are very robust.

The second robustness test concerns the categorisation of global and regional cities. In this paper, we define a global city as a city ranked in the specification of the Globalization and World Cities Network in the year 2000, and the other OECD cities are assumed to be regional cities. To this end, we also check two alternative definitions. In definition 1, only the Alpha and Beta cities in the GaWC list are defined as global cities, and all remaining cities are defined as regional cities. In this case, our sample is divided into 35 global cities and 212 regional cities. In definition 2, global cities are defined as the Alpha, Beta, Gamma, High Sufficiency, and Sufficiency cities in the GaWC list. Thus, the sample in this model is divided into 89 global cities and 158 regional cities[vi]. As shown in Table 3, columns 2 and 3, the APS connection still plays a significant role in both total and non-APS sector investment flows. The impact of flows to global cities on nearby regional cities is significant only when Gamma, High Sufficiency, and Sufficiency cities are defined as global cities (definition 2). When they are defined as regional cities (definition 1), the finding is turned on its head. The inflows to newly defined regional cities have a significant impact on the global cities. This indicates that the lower-tier GaWC cities, including Gamma, High Sufficiency and Sufficiency cities, are not (overly) dependent on Alpha and Beta cities. The APS firms connect these middle layer cities or lower-tier world cities with the world network and benefit the surrounding cities without APS firms. On the other hand, this also indicates that our empirical findings depend on the operational definition of 'urban' and 'hinterlands'.

<< Table 3 about here >>

In addition, we acknowledge there are several potential disadvantages of this definition. First, given that OECD countries are mainly located in economically developed countries, our conclusions are relevant to a specific hinterland geography (e.g. Kanai et al. 2019). However, our approach has the potential to be extended to a more comprehensive analysis.

Second, our analysis focuses exclusively on hinterland real capital investment flows as evidence of potential global city regional economies, but it does not consider the knowledge capital flows analysed in regional case studies, which provide insights into the network role of middle places (see, e.g., Doran and Fox, 2016; Shi, 2018). Therefore, our two-layer classification adopted for a global analysis may oversimplify hinterland inter-scale interactions and mutual relations. Figure 4 also illustrates examples of potential functional hinterland overlaps in Europe and the US whereby regional cities might 'use' two or more global cities as nodes connecting them to external capital flows. For example, in the UK, Leicester and Coventry could be influenced by London whilst being more dependent on flows articulated through Manchester.

Third, our analysis focuses on the city network formed by APS firms. Despite their importance, global functions are but one facet of inter-city relations and flows, and they must be complemented by analysis of sub-global industry specific networks, such as globalizing national energy sub-networks (Martinus et al., 2015). Large investment inflows to Houston may be in the energy sector, and energy corporation may play a critical role in connecting Houston, Perth, Sydney, Newcastle, etc. Indeed, the complex layering of FDI flows across the world shown in Figure 2 highlights that multiscale and multi-functional city interactions and mutual intercity capital flows in different parts of the world require further investigations into CFT/CPT processes. Our empirical method can be used to map capital flows on non-APS networks and national subnetworks. However, the main focus of this paper has been to link CFT and CPT.

Conclusion

In this paper, we have shifted the focus of the analysis on the two generic external urban relational processes specified by Taylor et al. (2010) to global city-regions and intercity capital flows. We argue that both relations can explain urban spatial patterns at different levels. 'City-ness' is more likely to be found in global cities; while at the local level, the town-ness process can be used to explain the formation of urban-hinterland relations. Nevertheless, the key purpose of the conceptual shift has been to explore how local/regional processes complement nonlocal/global processes: we have provided direct empirical links between the two processes, as schematically portrayed in Figure 1.

Our analysis is based on a comprehensive database of cross-border investment flows at the city level, which includes both greenfield investment and M&A across 247 OECD cities. We divided these cities into global cities and regional cities according to the location of APS firms. For global cities, we find that their investment flows can be mapped on the APS activity network. This confirms the validity of CFT, that is, capital flows are interlocked via the world city network. The network activities generated by different economic agents with trans-functional and trans-geographical potential can promote cross-border investment flows. A one percentage increase in office connectivity is associated with a 0.68 percentage increase in capital inflows. Cities that are more central to the network attract more investment flows. The impact can spill over to other sectors.

We then focus on the local dimension in urban external relations, which refers to CPT. Our empirical analysis shows that investment flows to global cities can have a capital flow spillover effect: a one percentage increase in the flows to the global cities is associated with a 0.13 percentage increase in the investment flows to proximate regional cities. The finding confirms the rise of 'city network externalities' proposed by Meijers et al. (2016). The positive spillover effect also implies that there could be positive effects associated with being proximate to global cities. This should also be considered by research on agglomeration shadows.

Previous research has revealed the uneven distribution of APS global connectivity across space. This is generally sharply apparent at the hinterland level in both developed and developing economies, explaining territorial policies aiming to promote spatially balanced, polycentric urban development (Van Meeteren et al., 2016). Against this backdrop, the empirical contribution of this paper is its demonstration of the influence of the global APS network on the spread of high-value capital flows to regional cities. Therefore, a singular policy focus on spatially balanced development requires a nuanced reconsideration of functionally polycentric urban relations in spatially hierarchical regions in the light of our findings. Our analysis not only begins to address the missing link between these urban dynamics and agglomeration theory, but it also illustrates how the linking mechanism can operate using the example of real capital flows, which territorial policies aiming to promote regional economies should take into account. The inherent complexity of global cities is reflected in global city-regions that have strong hierarchical tendencies but are not as simple as the original CPT suggests. Cross-border city flow relations and local hinterland patterns are analytically relevant, both by themselves and together.

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[i] The service value of a city to a firm is a measurement of the relative importance of the office in a certain city within the firm's overall office network. These values range from 0 (a firm having no office in a city) to 5 (a city housing the global headquarters of a firm).

[ii] The advanced service sector includes accounting, advertising, insurance, investment management, management consulting services, legal services, banking, scientific and technical services, auxiliary financial services and business school services.

[iii] Excluding regional cities generates quantitatively robust results. If we estimate the model $FLow_{i,j}^{G} = \exp[a + \beta^{APS}\ln(r_{i,j}^{APS}) + \delta\ln(Dist_{i,j}) + \gamma_1\ln(Econ_i) + \gamma_2\ln(Econ_j) + \ln(e_{i,j}^{G})$ using only global cities, β^{APS} is significantly positive and has a value of 1.50. The complete regression results are available upon request from the authors.

[iv] The geographic distance is calculated based on the 'haversine' formula and the latitudes and longitudes of the cities. In a separate analysis, we also used the driving distance and driving time as proxies. The driving distance is measured using the Google Map API for every two cities. The driving time is measured using the Google Maps

Application Programming Interface (API) for each pair of cities. When replacing the geographic distance by the driving time with a bandwidth of 6 hours, the significant positive influence holds. When using the driving distance with a bandwidth of 600 km, the results are also robust. A one percentage increase in the flows to nearby regional cities is associated with a maximum 0.11% increase in the investment flows to the regional city. The complete regression results are available upon request from the authors.

[v] Our empirical results only show the average intensity of the relationship among the 247 OECD cities based on the APS global network. When multi-scale networks are included, some regional globalizing centres may influence flows to global cities in some specific sectors (see, e.g., Martinus, et al., 2015). However, given the limited space and the scope of this study, we leave in-depth individual case analyses for future research.

[vi] Appendix 1 lists four groups of cities: Alpha and Beta level GaWC global cities; Gamma, High Sufficiency, and Sufficiency level GaWC global cities, remaining GaWC cities, other OECD regional cities that are not included in the GaWC list.